WEST VALLEY NUCLEAR SERVICES COMPANY

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West Valley Demonstration Project

TEST PROCEDURE

SF-12 VITRIFICATION QUALIFICATION RUN II

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RECORD OF REVISION

PROCEDURE

If there are changes to the procedure, the revision number increases by one. These changes are indicated in the left margin of the body by an arrow (>) at the beginning of the paragraph that contains a change.

Example:

> The arrow in the margin indicates a change.

Rev. No.	Description of Changes	Revision On Page(s)	Dated
0	Original Issue	All	09/89

RECORD OF REVISION (CONTINUATION SHEET)

Rev. No.	Description of Changes	Revision on Page(s)	Dated

WVNS-TP-019

SF-12 VITRIFICATION QUALIFICATION RUN II

REV. 0

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SF-12 VITRIFICATION QUALIFICATION RUN II

REV. 0

1.0 SCOPE

The purpose of this document is to provide the detailed operating instructions for Run SF-12, Qualification Run II for vitrification equipment. The objectives of this run, along with data requirements and prerequisites, are contained in WVNS-TRQ-019, "Test Request SF-12 Vitrification Qualification Run II". Figure 1 is a simplified flow sheet of the run equipment. Specific run activities are described in Section 8.0.

2.0 DEFINITIONS AND ABBREVIATIONS

Air Displacement Slurry (ADS) Pump - Reference device for the transfer of feed slurry. The feed ADS pump is used to transfer feed from the Feed Hold Tank to the SFCM. The sample transfer pumps from the MFHT and CFMT are called the MADS pump and CADS pump respectively.

Component Test Stand (CTS) - Building housing the Vitrification equipment.

Concentrator Feed Make-Up Tank (CFMT) V-001 concentrator vessel used for preparation of feed batches located in the CTS pit.

Data Acquisition System (DAS) - DCS subsystem which communicates with the DDS 7800 multiplexed data system for transfer of data not routed through Micon controllers.

Distributed Control System (DCS) - Overall process control and data handling equipment.

Data Historian (DH) - DCS subsystem to save process data on storage discs.

Melter Feed Hold Tank (MFHT) - V-011 Feed hold up tank located in CTS pit which contains the waste and glass former slurry prepared for Vitrification in the melter.

Functional and Checkout Tests (FACTS) - Test program to verify vitrification process parameters.

High Efficiency Mist Eliminator (HEME) - (V-034) Mesh pad off-gas scrubbing device located on the CTS apron.

SF-12
SLURRY FEED FLOW DIAGRAM

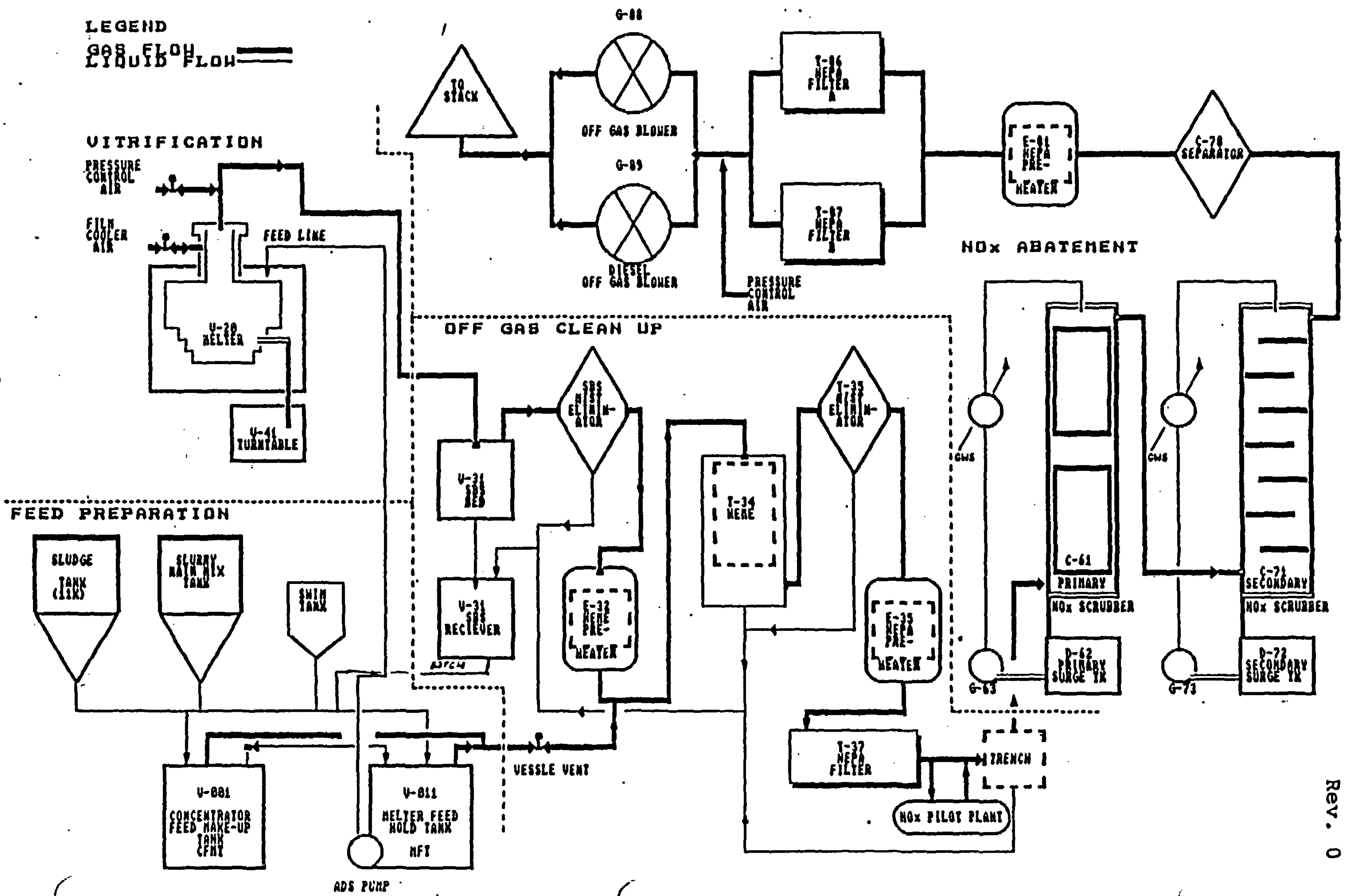


FIGURE 1

High Efficiency Particulate Air Filter (HEPA) - Filter used in the vitrification process in several places. Process filter is T-037 located on the CTS apron and final filter is T-086, 087 in the 01-14 Building.

Immediate Danger to Life and Health (IDLH) - Short-term exposure limit to contaminant.

Industrial Work Permit (IWP).

Outside Feed Storage Tank (OFST) - (D-018) 11,000 gallon tank located just west of the CTS, used for feed hold-up.

Piping and Instrument Diagram (P&ID) - Drawings used to define process control hardware for process system.

Run Sheet Value (RSV) - Designated Control set point found on posted run sheet.

Safe Working Load (SWL) - Capacity of rigging equipment.

Self Contained Breathing Apparatus (SCBA).

Submerged Bed Scrubber (SBS) - V-31 First element in SFCM off-gas clean-up train. Cools and scrubs off-gases.

Slurry Fed Ceramic Melter (SFCM) - V-20 Vitrification process reactor.

Slurry Sample Station (SSS) - A tray on the CTS condenser stand holding the Hydragard slurry samplers for the CFMT and MFHT.

Silicon Control Rectifier (SCR) - Solid state electronic device for heater power control.

Selective Catalyst Reduction (SCR Pilot Plant) - Method for reacting NO_x with ammonia to form N_2 and water for atmospheric emissions control. Test catalytic pilot plant is located at the south end of CTS.

Shift Engineer (SE) - Designated individual on-shift during testing to provide direction and data interpretation. The SE is responsible for the technical operation of the run.

Threshold Limit Value (TLV) - airborne concentration limit for chronic exposure to a contaminant, (40 hour per week).

Temporary Cold Chemical (TCC) - Actual cold chemical preparation tanks and equipment, installed, temporarily, on the west side of CTS.

Temporary Cold Chemical Make Up Building (TCCMUB) - Temporary building on the north east corner of CTS. The building houses two 1000 gallon fiberglass reinforced plastic, FRP, makeup tanks with agitators.

VAX - Digital Corporation computer Model 8350 used as Process Computer.

Vitrification Operations Shift Supervisor (VOSS) - Shift Supervisor in CTS responsible for operation of vitrification equipment. For the purposes of the test procedure, VOSS also refers to a Vitrification Test Supervisor.

01-14 Building - Process Building containing off-gas blowers and NO_x scrubbing equipment.

11K Tank - See Outside Feed Storage Tank, above.

3.0 RESPONSIBILITIES

3.1 A Shift Engineer (SE) from Vitrification Test Group will be present during the run to direct the technical operation of the equipment. The shift engineer is authorized to modify run parameters within the ranges and limits specified in this Test Procedure to achieve objectives of the run. The assignment as Shift Engineer will be made by the Test Engineering Manager and is addressed in Paragraph 5.16.1.

3.2 The Vitrification Operations Shift Supervisor/Test Supervisor (VOSS) is responsible for operation of the equipment as described in this test procedure, and the supplementary instructions from the SE. The VOSS has responsibility for the interface with plant equipment and utilities. The assignment as VOSS will be made by the Test Group Manager.

3.3 QA to perform surveillances as deemed appropriate in conjunction with hold point releases or other QA planning documents.

4.0 TOOLS, EQUIPMENT, COMPONENTS, AND REFERENCES

4.1 Tools and Equipment

The following equipment shall be generally available in the area by Vitrification Operations during melter operations:

a. Work gloves;
b. High temperature gloves;
c. Insulating blanket (Fiberfrax type);
d. "Kwik Kold" packs for burns;
e. Tru RMS volt-ohm meter;
f. Tru RMS clamp on amp meter;
g. Tool box with tools;
h. Face shields;
i. boots, aprons, and rubber gloves; and
j. Self-Contained Breathing Apparatus (SCBA)

4.2 Components

Major components operated as part of Vitrification runs include:

Vessel	Location
CFMT V-01	CTS Pit
MFHT V-11	CTS Pit
SFCM V-20	CTS Pit
Turntable V-41	CTS Pit
SBS V-31	CTS Pit
SBS Mist Eliminator T-32	On Top of the SBS
HEME Preheater E033	On Top of the SBS
HEME V-34	Temporary; CTS Apron
HEPA Preheater V-36	Temporary; CTS Apron
Process HEPA filter V-37	Temporary; CTS Apron
CLCW Hold Tank	CTS West Aisle
Main CLCW Circulation Pump	CTS West Aisle
Spare CLCW Circulation Pump	CTS West Aisle
CLCW Heat Exchanger	CTS West Aisle
Primary NO_x Scrubber C-61	01-14 OG Cell
Secondary NO_x Scrubber C-71	01-14 OG Cell
OG HEPA Filter T-87	01-14 Fourth Floor
OG Blower K-88	01-14 Fourth Floor
OG Back-up Blower K-89	01-14 Fourth Floor

4.3 References

Test Request WVNS-TRQ-019, "Test Request SF-12, Vitrification Qualification Run II".

Drawings

900E-705	P&IDs for Process Equipment in CTS, Sheets 1-18
900D-943	P&ID for Temporary CLCWS
01-110-1, -2 and -3	P&IDs for Off-Gas Equipment in the 01-14 Building

Standard Operating Procedures

SOP 63-3	Vitrification Off-Gas Treatment System NO_x Analysis
SOP 63-4	Turntable Operation
SOP 63-5	Distributive Control System Operation
SOP 63-6	01-14 Solution Transfer
SOP 63-7	Temporary Cold Chemical Solution Transfer
SOP 63-8	Melter Feed Hold Tank Solution Transfer
SOP 63-9	11K Hold Tank Solution Transfer

Standard Operating Procedures

SOP 63-10	Submerged Bed Scrubber Solution Transfer
SOP 63-11	6K Hold Tank Solution Transfer
SOP 63-19	Vitrification Operating Practices
SOP 63-20	Vitrification Feed Preparation
SOP 65-01	Temporary Cold Chemical System Nitric Acid Receipt and Distribution
SOP 65-02	Temporary Cold Chemical System Sodium Hydroxide Transfer and Distribution

Powell-Process Systems, Inc.

Micon P-200 Controller Function Description
Micon MDC-200-1 Display Description and Operation
Micon MDC-200-1 CRT System Configuration.

Research, Incorporated

Melter Power Supply Manual

5.0 GENERAL INFORMATION, EMERGENCY RESPONSE, STANDARD PRACTICES, SAFETY AND OPERATING LIMITS/RANGES

The Vitrification System equipment will be operated in accordance with the plan laid out in this section. The equipment operation is described in Section 6.0 of this document. The necessary prerequisites and limits are presented below. First, the process flow is described with emphasis on those elements of greatest concern for the test; a flow sheet of the process has been included as figure 1. Second, the activity diagram is presented to organize the various activities which must come together for the integrated operation; and lastly, the run sheet limits provide the envelope permitted to accomplish the run. The Shift Engineer may vary run parameters within these limits, which are set based on run objectives.

5.1 Run Description

Run SF-12, Vitrification Qualification Run II, will be a long term operating period. Prototypic operation of the Vitrification equipment will be held for 45 days in order to identify interactions and problems which do not show up during shorter runs. Since the complete system is not available, certain adjustments are made relative to the final design.

The Melter and the other CTS pit components are designed for eventual "hot operations" although the melter itself will be replaced by a second generation unit. The Temporary Cold Chemical system is prototypic of the final cold chemical system, and many of the major pieces of equipment will be used in the final system.

Methods of measurement and delivery are identical to the final design. The Off-Gas components only approximate conditions as they will be in the final system. Although the HEME and HEPA Process Filter were designed to be prototypical to the final components, the added load of the Vessel Vent system has not been added in as yet. Feed concentration as it effects both Off-Gas treatment and the water balance has not been integrated into a FACTS run before SF-12. The long term nature of this run will require feed preparation to continue the run beyond about 14 days. Of course, there is not a second train of Off-Gas treatment equipment available, and the NOx treatment equipment and facility will be redesigned following completing of the pilot plant testing.

5.1.1 General

SF-12 is scheduled to last a nominal 45 days. A minimum on-line efficiency of 70 percent relative to 45 kg/hr glass production is necessary to demonstrate an ability process the waste within the melter three year design life. Because a 45 day run is short relative to either an 18 month process campaign, or three year melter life, a 90 percent on-line efficiency should be a realistic target for SF-12.

A feed batch is expected to last approximately 6 days, requiring about 7 feed batches to run for 45 days.

This run will be conducted to collect qualification data for the Waste Qualification Report, WQR, during steady-state operation. There are no plans to use the bubbler during the run; although it will be installed, however, mass balance verification, sample system validation, and particulate sampling will continue in a data collection mode.

This Qualification Run will be conducted to mirror operations as they would be in the radioactive mode. The results from earlier FACTS runs have indicated the preferred operating modes for the equipment. These modes, however, must be supportable within the limits of remote processing. As an example, a recirculation loop exists in the ADS pump piping. It has been used to test the pump and to recirculate feed during runs to enhance pump operation. This recirculation loop will not be present later, and will not be used in this run. For each glass control variable, the control strategy is outlined in appendix D. The main control variables are: glass processing temperature, feed rate control, and feed and product composition.

5.1.2 Feed

There will be several batches of feed made up during SF-12. The first two batches will be completed before the run and stored in the MFHT and the CFMT. Starting with glass former batch 3, the feed will be made up per Work Order and SOPs. The implementing work order will reference SOP 63-20, Vitrification Feed Preparation, and the SOPs for the Temporary Cold Chemical System equipment. The feed preparation SOP describes the interaction between Vitrification Operations, Analytical and Process Chemistry, and Vitrification Process Development so that each group is aware of the responsibilities and requirements to provide accepted feed within the batch cycle time. All of the feed will be made up from an 8D-2 simulation mix stored in the OFST, D-18 (11K Tank), and glass make up chemicals from TCC. Feed heels remaining from SF-11 have been minimized to simplify mixing in the first batches, but recycle from the SBS will be included in the waste batch.

A flow chart of the feed preparation process, figure 2, shows the 8D-2 simulant preparation process for the run. Tank 8D-2 simulant slurry is made up as a metal ion analog to the actual 8D-2 simulant, but the chemical form is not duplicated. (The tank is in the neutralized nitrate form.) Also, the 8D-2 simulant batch concentration will not be controlled relative to the combined 8D-2 mixture. Table 1 is the recipe for a batch of 8D-2 simulant. The 8D-2 simulant for all of the feed batches will be prepared before the run.

The 8D-2 simulant and feed batches will be analyzed to verify that the final composition is within the tolerances of the West Valley Reference Glass, WVRG. The WVRG composition is shown in table 2, together with the acceptance band. Feed acceptance is based on multiple analysis of the feed batch and the resultant sample statistics for each element. A mean for the analytical results shall be determined for each glass component (except oxygen) which is at least 0.5 weight percent of the total glass oxides. The error limits for each of the "estimates of the true mean" (or actual concentration), for a 95 percent confidence level, shall be less than 10 percent of the mean. A small error band on the mean indicates that the sampling and analysis have been done consistently, which tends to validate the result. The sample means shall be within 10 relative percent of the target. This calculation may be done on total glass oxides or metals basis. Finally, a maximum sulfur concentration of 0.3 weight percent shall be observed because of the low solubility of

SF-12 FEED MAKE UP

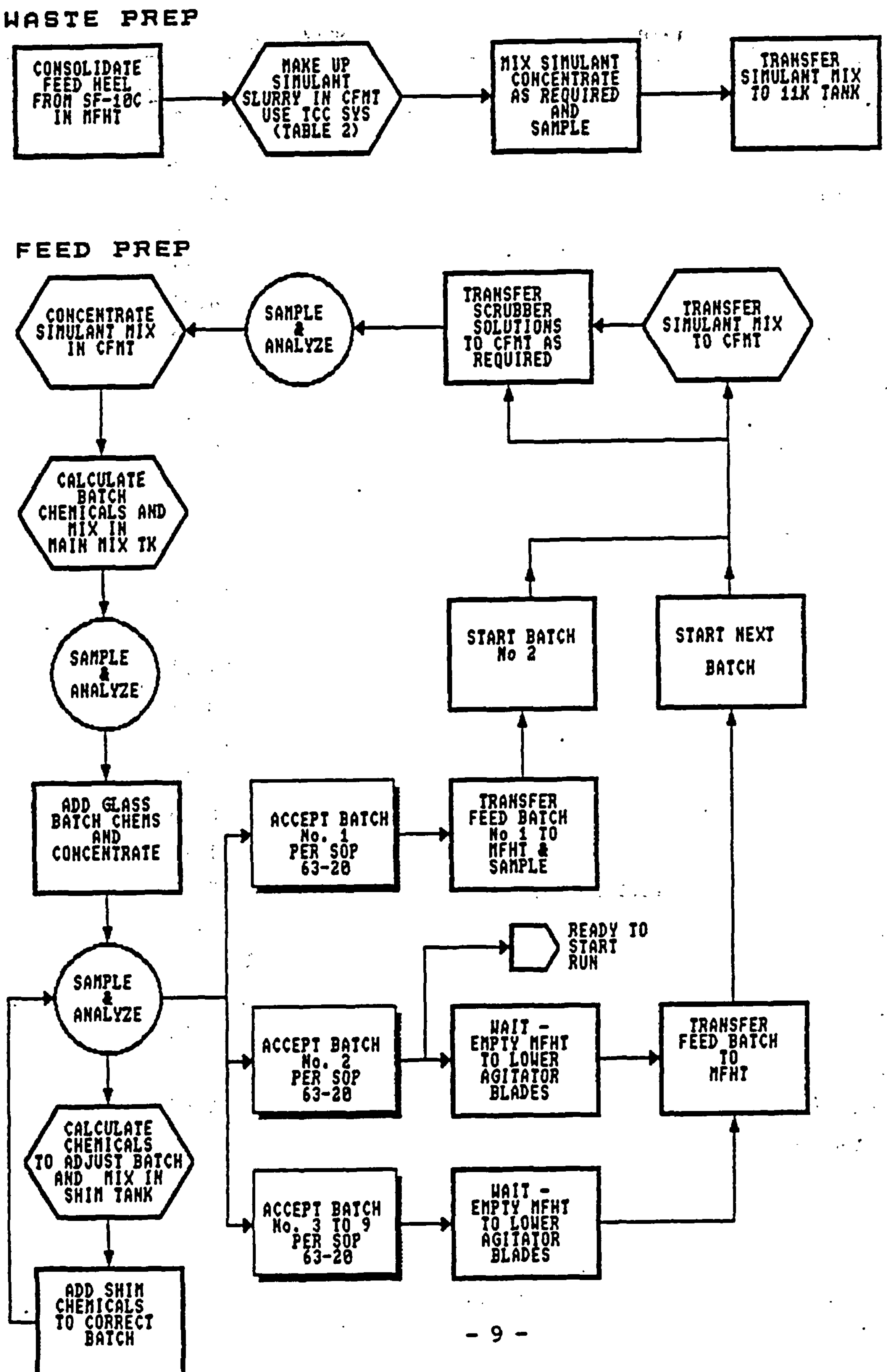


FIGURE 2

TABLE 1: 8D-2 SIMULANT BATCH FEED CHEMICAL ADDITIONS

* Glass Formers

CONSTITUENT	Kilograms
* $Al(OH)_3$	129.43
* $Na_2B_4O_7$	0.70
* $Na_2B_4O_7 \cdot 10\ H_2O$	11.98
$Ba(OH)_2 \cdot 8\ H_2O$	11.16
$Ce(OH)_4$	7.84
Cr_2O_3 * 1.5 H_2O	16.02
$Cs(OH)$ * H_2O	8.49
$Fe(OH)_3$ (13 wt.% Sol'n) Dry	1891.34
* KOH	0.00
La_2O_3	2.92
* LiOH * H_2O	0.00
$Mg(OH)_2$	3.94
MnO_2	83.53
* NaOH	458.01
Nd_2O_3	11.02
$Ni(OH)_2$	24.93
NaH_2PO_4	94.77
Na_2SO_4	20.71
* SiO_2	67.11
* TiO_2	0.00
Y_2O_3	1.29
$ZrO(NO_3)$ * 2 H_2O (42.73 wt.% Sol'n) Dry	599.82
Na_2MoO_4	0.83
Zeolite IE-96	1335.00
$Cu(OH)_2$	7.16
ZnO	3.24
$Sr(OH)_2$	1.25
Sodium Chloride	1.07
Sodium Fluoride	15.75

TABLE 2

WEST VALLEY REFERENCE GLASS COMPOSITION

WEIGHT PERCENT OXIDE	TARGET	LIMITS LOW	LIMITS HIGH	TRACER CANDIDATES
	Wt.%	Wt.%	Wt.%	
Al_2O_3	6.55	5.90	7.20	
BaO	0.07			soluble
B_2O_3	10.28	9.25	11.31	
CaO	0.50	0.45	0.55	
CeO_2	0.16			
Cr_2O_3	0.14			
Cs_2O	0.10			
CuO	0.06			insoluble
Fe_2O_3	12.14	10.93	13.35	
K_2O	3.74	3.37	4.11	
La_2O_3	0.04			
Li_2O	3.15	2.83	3.46	
MgO	0.91	0.82	1.00	
MnO	0.99	0.89	1.09	
MoO_3	0.05			
Na_2O	11.44	10.30	12.58	
Nd_2O_3	0.14			
NiO	0.25			
P_2O_5	2.37	2.13	2.61	
Pr_6O_{11}	0.04			
SO_3	0.23		0.30	
SiO_2	43.46	39.11	47.81	
SrO	0.03			soluble
TiO_2	0.81	0.73	0.89	
Y_2O_3	0.02			
ZnO	0.02			insoluble
ZrO_2	2.31	2.08	2.54	
TOTAL	100.00			

sulfur in the glass. Feed acceptance for use takes place as part of SOP 63-20. Upon feed batch acceptance, the control room shall be notified and the Activity Diagram signed off as ready for use.

Sugar and nitric acid is added to the feed based on calculations from earlier experimental work and compared to laboratory work on the actual feed. Shimming of the feed with either of these components may take place during the run for redox control.

The feed compositions may also be modified by the addition of tracers to follow component mixing behavior. Barium oxide (BaO) and zinc oxide (ZnO) will be alternated for each batch.

The target feed concentration is 425 grams oxide per litre ±5 percent in the MFHT. The CFMT concentration will be diluted by jet transfer, this will be taken into account. This is a normal and necessary result of the slurry sampling and transfers; the dilution will be tracked by samples through the run.

To maintain steady-state operating conditions, if the preparation of a batch exceeds the desired batch cycle time, the feed rate may be reduced and/or feed diluted, as determined by the shift engineer. The progress of the feed preparation will be monitored to determine the need for extending the batch cycle time.

5.1.3 Melter Conditions

Prior to the run, the SFCM tank will be adjusted to bring selected constituents of the glass to the target concentrations. A single adjustment may be made to the silicon, sodium, boron, and potassium. This adjustment will be made at least five days before the start of feed to allow for the tank to come to equilibrium.

The melter power skewing configuration has been set at a ratio of 1:1.45 for both the A:B and A:C circuit ratios. This configuration was arrived at after observing the melter temperature profile at different skewing ratios. Power is skewed slightly toward the bottom to keep the bottom hot, and still not cause any circuit to circuit interactions. This ratio is input as a run sheet value, which allows changes to be made by the shift engineer if the operating situation warrants, such as a bottom electrode colder than normal (980°C). In general, however, we do not expect to change the ratio.

5.1.4 Slurry Sample Station

The slurry sample station, SSS, is located on the west side of the condenser stand. The station is a window tray for the vitrification cell NW window. The permanent SSS will be equipped to sample the CFMT, the MFHT, and provide a spot to work with the "C" sampler for the SBS. Each slurry tank has sample ADS pump to deliver samples up to a Hydragard sampler positioned on the tray. Samples will be pulled from the device to show operability, and to validate the sampling technique.

5.2 Activity Diagram

The run will be followed by use of the activity diagram, figures 3 and 4. The activity diagram will serve as a road map to the different sections of this procedure, by providing references to the detail for each portion of the run.

Section 5.0 includes the activity diagram, and the response procedures in case of abnormal conditions.

Section 6.0 covers the equipment description of the components used in the test.

Section 7.0 provides the start-up procedures and check off sheets to bring the vitrification to the point of starting the run. Start-up procedures for CFMT boil down are also included.

Section 8.0 presents the instructions unique to this test, including the data and sampling requirements for the run.

Section 9.0 provides shut down procedures and check off lists.

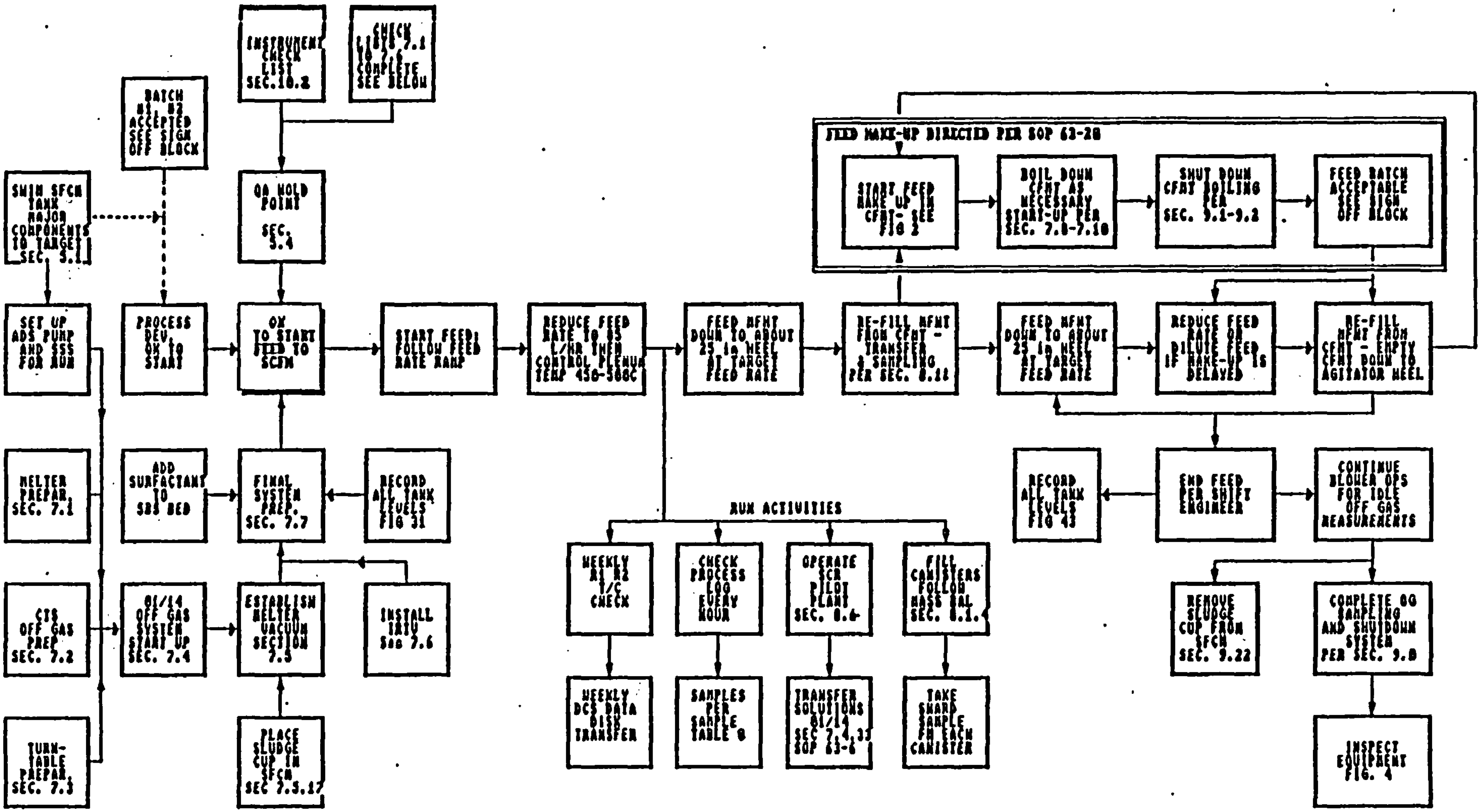
Section 10.0 describes the automatic data collection features and requirements including configuration control. A list of all active instruments used in this run is included as appendix B.

A copy of the activity diagram will be posted in the operating area for documenting run progress by signing off the completed node on the posted diagram and by log entries. Minor modifications to the activity diagram, such as the order of activities within the scope of the experiment, may be made by the SE noting the change on the diagram and in the test log.

5.3 Run Sheet Limits/Ranges

Run sheets list run control parameters for the process as figures 5, 6, 7, and 8. They include limiting ranges as appropriate for the run. The run sheets are filled in with the acceptable ranges of each operating parameter for the run. Run sheets with the control set points or operating range will be filled out and signed by the Shift Engineer to post the necessary values for the control of run equipment. See Section 10.4 for process log.

SF-12 ACTIVITY DIAGRAM



FEED BATCH READY TO FEED PER SOP 63-20:

#1______ #2______ #3______ #4______ #5______ #6______ #7______ #8______ #9______

FIGURE 3

SF-12 ACT. DIAGRAM - SHUTDOWN

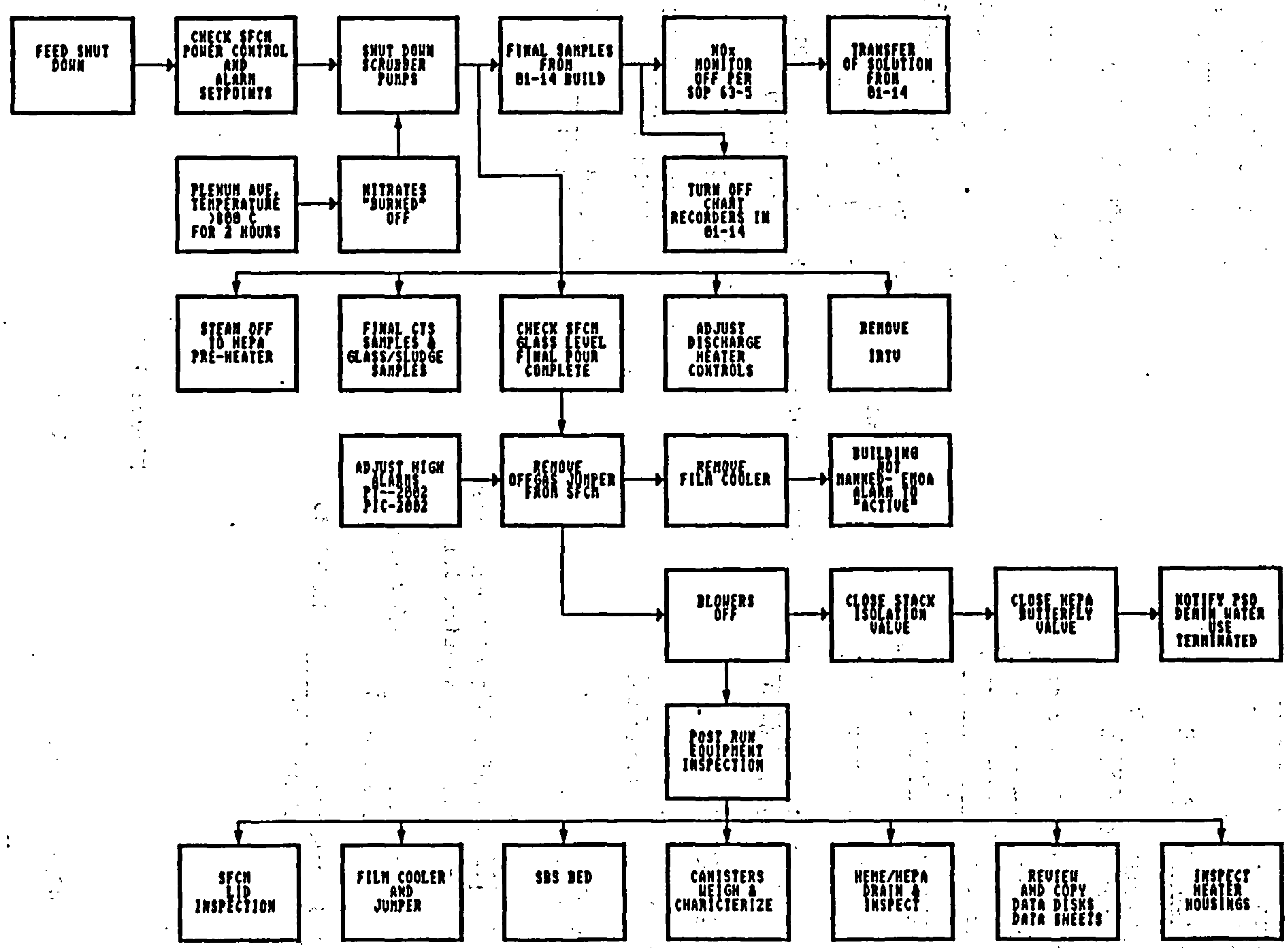


FIGURE 4

MELTER RUN SHEET

MELTER TRANSFORMERS

Current Tap Setting:
Circuit A __________
Circuit B __________
Circuit C __________

GLASS TEMPERATURE

TIX-2031 _______ °C
limit 1080-1220

Controller default settings:
Circuit A ____________ %
Circuit B ____________ %
Circuit C ____________ %

REFRACTORY COOLING

Dam Cooler _________ SCFM TIC-2034 Man/Auto
limit 0-50

Trough Cooler ________ SCFM TIC-2035 Man/Auto
limit 0-50

FEED/PRODUCT

Airlift FIC-2013 _____ SCFM
limit 0-2

Bubbler ______ SCFM
limit 0-2

Fe^{++}/Fe^{+++} __________
limit 0.05 - 0.5 48 hours after
start-up - see section 8.13

ADS Feed Rate _________ l/hr (RATD)
limit 0-300

ADS Pressure __________ % HIC-1135
limit 0-100

DISCHARGE HEATERS

TIC-2001 __________ A/M/C
limit 500-1175
TIC-2002 __________ A/M
limit 500-1175
TIC-2003 __________ A/M
limit 500-1175

ELECTRODE COOLING

Bottom TIC-2051 ________ °C
limit 900-1100
West TIC-2061 ________ °C
limit 900-1100
East TIC-2071 ________ °C
limit 900-1100
Shroud A ______ SCFM
limit 0-50
Shroud B ______ SCFM
limit 0-50
Shroud C ______ SCFM
limit 0-50

PRESSURE CONTROL

PIC-2004 ______ INWC
limit 15-0

FIC-2020 ______ SCFM
limit 40-150

Figure 5

CTS OFF-GAS RUN SHEET

SBS

Bed Level ________ in w.c.
LT 310-1 limit 40-65

ΔP Bed __________ in w.c.
DPT 310-1 limit 30-60

HEPA PREHEATER

Temp. TT-3601 Man/Auto __________ °C
limit 50-110

HEME PREHEATER

Temp. TIC-3301 ___________ °C
limit 10-150

Vessel Vent

FT--1901 ________ SCFM
limit 0-70

Figure 6

CLCWS RUN SHEET

Date: ______________________

Shift Engineer: ______________________

Mode: ______________________

Low Pressure Header

Pressure

PIC-5835 ________ psig
limit 20-45

Turntable Jacket Flow

FT-4109 _______ gpm
limit 0-50

SFCM Jacket Flow

FT-2015 ________ gpm
limit 20-70

SFCM Bottom Flow

FT-2106 _______ gpm
limit 0-30

MFHT Flow

FT-1119 _______ gpm
limit 0-75

High Pressure Header

Pressure

PIC-5850 ________ psig
limit 25-60

SBS Bed

FT-3107 _________ gpm
limit 20-200

SBS Receiver

FT-3118 ________ gpm
limit 0-100

SFCM SCRs

FI _______ gpm
limit 5-15

CFMT Side Coil

FT-0103-B _____ gpm
limit 0-100

CFMT Bottom Coil

FT-0101-B _____ gpm
limit 0-100

Figure 7

01-14
OFF-GAS RUN SHEET

LIMITS/RANGES

Date:______________________

Shift Engineer:______________________

Mode:______________________

BLOWER

Vacuum PIC-100	________ limit -60 - -120	in w.c.	Electric	Lead/Standby
Temperature TD1C - 148	________ limit 0-35	manual	Diesel	Lead/Standby
Preheater Temperature	________ limit 40-75		Either unit may be lead	
Screen ΔP	30 (max)	in w.c.		

Scrubber Columns

	PRIMARY	SECONDARY
Peroxide concentration	%H_2O_2 limit >2	%H_2O_2 limit >1
Measuring Pot Level	________ in limit 5-30	________ in limit 5-30
Scrub Solution Temperature	Cooling water run at 100% for maximum cooling.	

NO_2 Operating Limit 2600 ppm Post Scrubber
1300 Post Blower

AIX-6101, 2 limit 10 lbs/hr Post Scrubber

Figure 8

5.4 QA Hold Points

Prior to the start of melter feed, a Quality Inspector shall verify, by signing off on the activity diagram, that the following activities have been completed:

1. Instrument List Checked:

   All instruments have been checked and noted as operable or inoperable. See Section 10.2 for instrument check-out procedures. QA to check that the instrument list has been completed, dated, and initialed by Operations.

   NOTE: The principal instruments have been signed off as operable as part of the start-up check sheet.

2. Equipment Start-Up Check List Complete, Sections 7.1 to 7.6.

   NOTE: QA will perform surveillances as appropriate during the melter run.

EMERGENCY RESPONSE

The following instructions provide initial responses for off-normal events in the CTS. In the event of any emergency involving the melter and equipment notify the shift supervisor and shift engineer, who will notify the Vitrification Test Group manager. A call list is available in the front of the Melter Operation Log.

5.5 Loss of Melter Power

Stop feed. Check SCR cooling water flow, melter alarm panel and CTS substation for indication of problem.

5.6 Loss of CTS Power

Check 5.5 above. DCS is provided with a minimum of one hour of backup power by the Uninterruptible Power System (UPS) to shut down the system. Shut down Melter feed, go to idle mode. If feed was on, cool Submerged Bed Scrubber (SBS) to maximum extent possible until feed pile has burned off. Check that the backup Closed Loop Cooling Water System (CLCWS) pump and backup off-gas blower are operating. Melter temperatures may be checked by hand held thermocouple meters.

5.7 Loss of Off-Gas Blower

Start second blower (should come up on autostart). Stop feeding nitrate, or nitrite containing feeds to the melter, and shut off steam to the MFT and CFMUT. Go to the idle mode.

Remove IRTV periscope from the melter if cooling cannot be maintained. See section 7.6 for trouble shooting and removal logic.

NOTE: 1) Melter can pressurize and vent to the CTS on loss of ventilation if the melter emergency vent fails to function.

2) Frit or dry chemicals may be fed to the melter with one blower operating and no standby.

5.8 Loss of Cooling Air

Maintain the electrode temperature below 1,150°C by reducing melter glass temperatures as necessary. See 5.14 for IRTV cooling.

The overflow section temperature may be reduced to below 900°C, if an extended outage is expected.

The instrument and utility header may be cross connected to provide electrode cooling, provided the failed supply header is isolated from the main plant. Other air users should be shut down.

5.9 Loss of Cooling Water

5.9.1 Start second cooling water pump (pump should start automatically).

5.9.2 If unable to restore cooling water flow, establish emergency cooling with utility water. Stop feeding melter.

Emergency Cooling Procedure

Melter Wall

1. At rack 7A, close Valves GT-130 and GL-025.
2. At rack 7B, open valve #8 on north side of rack.
3. At rack 7B, close Valve #4 and open Valve #7 (100 ft level).
4. At rack 7A, open valve #9 on south side of rack.
5. Monitor pressure on Gauge 66-PI-007 to no more than 15 psig. Adjust to 45 gpm flow on FT-2015.

SCR

1. Power down melter.
2. At NW utility station, open valve #1 fully.
3. Close Valve GL-121.
4. Open Valve #3 and adjust to 40 psig on Gauge 66-PG-0.
5. Return power to melter.

5.9.3 Loss of main plant cooling water will reduce the effectiveness of the SBS over time. Stop feeding until cooling can be reestablished. Notify the PSO Shift Supervisor.

5.9.4 On loss of main plant cooling water, shut down the steam on the CFMUT (if in use).

NOTE: Loss of cooling water will also allow the control room temperature to rise. DCS control and data acquisition are affected by temperatures above 30°C.

5.10 Evacuation

In the event the melter must be left unattended, stop feeding. Go to melter idle mode settings. All other equipment may be left unattended.

5.11 Loss of Instrument Air

Stop feed, go to the idle mode. Stop any solution transfer. Instrument air provides air to all pneumatic valves and instruments. Valves will go to "fail safe" positions. Instrument accuracy will decay. Notify the PSO shift supervisor.

5.12 High NO_x

1. Background - NO_x Control Methods

Normal control of the NO_x scrubbers involve keeping the peroxide concentration above 2 percent peroxide, and keeping the scrub solution pumps in operation. If control is not maintained, feed is stopped to allow the nitrate inventory to begin to deplete, while peroxide concentration, or scrub solution recirculation flow is restored.

Action - Notification

If the NO_x level exceeds 10 lbs/hr for any amount of time, the Vitrification Test Group Manager shall be notified. If 10 lbs/hr is exceeded for less than 15 minutes, normal day shift notification is acceptable.

2. Background - 10#/hr Limit

The normal operation of the monitors shall be with at least one monitor analyzing NO_x, at the post scrubber position. The scale shall be on 250X (0 to 6500 ppm). This reading will be used together with the system flow rate (FT--6101) to calculate the amount of NO_x leaving the Vitrification process. This reading, AIX-6101 or AIX-6102, will display the NO_x in pounds per hour. An alarm is set at 8 lbs/hr to alert the operator that the effluent concentration is rising.

Action - 10#/HR Limit Exceeded

If the NO_x level exceeds 10 lbs/hr for more than 15 minutes, the feed to the melter shall be shut down and steam to the CFMT shall be shut off until the system is brought under control.

3. Background - 2600 ppm Limit

A second limit is maintained to keep the NO_2 concentration below 2600 ppm. This limit will not be exceeded if the NO_x is less than 8 lbs/hr.

Action - 2600 ppm Limit Exceeded

Melter feed and/or CFMT steam shall be shut down if this limit is exceeded, as above.

5.13 Ammonia Release

In the event of an ammonia release to the CTS from the SCR pilot plant, the CTS shall be evacuated as indicated below.

1. If ammonia is smelled around the vicinity of the SCR pilot plant, personnel will exit the viewing platform. Isolate the ammonia source by closing the regulator outlet valve if possible.

2. If, in any area of the CTS, the ammonia concentration is high enough to cause discomfort and watering to the eye, that area shall be evacuated.

3. Return to any area that has been evacuated shall be by IWP. SCBA will be required for any recovery activities. Recovery will involve securing the source (Ammonia bottle) and increasing ventilation to the area.

NOTE: Ammonia is sensed by smell at 5 ppm, the TLV is 25 ppm, watering eyes at 150 ppm, and the IDLH is 500 ppm at 30 minutes exposure.

Acid/organic vapor full face respirators will be stationed on the viewing platform for use in evacuation if necessary.

5.14 IRTV Periscope

When the IRTV periscope is in place in melter Nozzle B, air cooling to the barrel must be maintained. Cooling air can be supplied from either instrument air (normal) or bottled air (back up). Remove periscope if cooling cannot be maintained. Detailed instructions and decision tree is referenced in section 7.6.9.

5.15 Loss of UPS Power

The UPS system will switch to line power in the event it detects an internal problem. This section deals with recovery from loss of both line and battery power.

In the event of loss of UPS power to the DCS and/or the VAX process computer, the following sequence shall be followed upon restoration of power.

1. Restore power to DCS, recharge batteries to UPS system as supported by the rest of the system.

2. The process computer will restart automatically, check that the four disk drive units have their run lights lit. VAX operators console will type start up messages.

3. Reset Micon Controller and force the backup Micon back to normal mode if possible.

4. Reset melter power at the EMOA bypass panel in CTS.

5. Restart melter power and start to ramp temperatures back to set point.

6. Restart process blowers if necessary. Emergency diesel blower should remain on line.

7. Verify that the PIC-2004 is operating at run sheet value; adjust as necessary.

8. Reset film cooler air flow and return set point to run sheet value.

9. Verify that the DCS data historian is operational; initialize on a new disk if it is down. Check that the DCS time and date are correct.

10. Verify that the VAX data collection is in operation (look for DCS_DYNAMIC in "SHOW SYS" listing, and check SHOWDAY program for current data).

11. Check all applicable run sheet value settings.

5.16 Standard Practices

The purpose of this section is to outline the various responsibilities and duties during the run, so that a clear understanding of what is expected is defined.

5.16.1 A Shift Engineer from Vitrification Test Group will be present during the run to direct the technical operation of the equipment. The Shift Engineer is authorized to modify run parameters within the run sheet limits to achieve objectives of the run and to modify this procedure using Test Exceptions (TEs) as outlined in EP-11-003. Technical conduct of the run will be as directed by this Test Procedure and as amended by the Vitrification Test Group Manager.

NOTE: Shift Engineers for this run are:

J. Paul
D. J. Ploetz
L. L. Petkus
B. J. Stout

Melter process/analytical technical recommendations from the Process Development Group shall be directed through the Test Group Manager for implementation.

5.16.2 In the event of a plant emergency or personnel injury, equipment under test will be put in a safe shutdown, or idling condition as necessary. The supervisor will direct plant operations under all such conditions.

5.16.3 At each shift change, the incoming Operators, Supervisors, and Shift Engineers will read the log book to update their understanding of the systems operational status. The review should take place as soon as possible after shift change as follows: 1) shift supervisors, shift engineers, and control room operators; 2) operators in direct support of melter and process equipment; 3) other personnel involved on shift. The above personnel will indicate their review of the operations log by log entry and initial. The historical period to be reviewed is the span since last on shift or five calendar days.

5.16.4 Log entries are to be made by Operators, Shift Engineers and any other involved Project personnel. In the development program of FACTS it is important that uncertainties, anomalies, unplanned events, and observations be recorded.

The entry shall have the time of the observation and the initials of the individual making the entry. Process control changes shall also be noted in the log such as power or flow rate changes.

5.16.5 A Shift Engineer shall review run data for the past shift as a check of run progress. The review shall include data sheets and operation of the automatic data logging equipment. This review will be documented in the shift summary log.

5.16.6 The run sequence is illustrated in the Activity Diagram, see section 5.2. This diagram shows the prerequisites and the interrelationships among the different pieces of equipment. The Shift Engineer will conduct the run, modifying the run sheet values as necessary to meet the run objectives. However, the change or addition must be logged in the operations log book including the reason for the change.

5.16.7 The start of run shall be noted in the Vitrification Log Book by the insertion of the following information:

1. Title of run - SF-12.
2. List of personnel involved in the run.
3. Reference to the Test Request(s) and Test Procedure(s) describing the run.

5.16.8 TEs will be generated per EP-11-003. Once generated, the test exception will be annotated in this procedure as follows:

1. For minor changes in content: make pen and ink modification to the TP, reference the TE number, and date/initial the change on the TP.

2. For major changes in content: cross through the original page in TP, insert copy of TE and reference the appropriate TE, date, and initial.

5.16.9 A morning summary shall be circulated each day of the run by 0700 hours. The summary will include the significant events of the past 24 hours.

5.17 Industrial Safety

5.17.1 The run activities and operation will use standard WVNS practices to assure safety including the Safety Analysis (HG:85:0226), IWPs, Lock and Tagging, Posted Operations Controls, and etc.

5.17.2 The Melter electrode cage will be closed and locked when the electrodes are energized. The Melter shall be shut down during a cage entry or an IWP will be issued to cover the situation.

5.17.3 When handling process solutions either for make up, sampling, or spill control, refer to the CTS monthly IWP (posted in the CTS control room). Protective clothing that is required includes: chemical resistant gloves and goggles.

5.17.4 The safety analysis describes the CTS as manned by at least two people during testing "in accordance with standard safety practices." To allow reasonable coverage at the site, plant safety practices permit operation personnel in radio contact to satisfy this basic safety requirement. Multichannel radios in use at CTS will permit vitrification operation to maintain adequate surveillance of CTS and contact with plant shift personnel as well as security.

5.17.5 Protective lenses shall be worn when glass sampling or observing glass samples. A face shield shall be worn for large samples, e.g., looking directly into the Melter cavity when the view glass is not in place.

5.17.6 Safety signs shall be posted around all accessible equipment which are at elevated temperatures.

5.17.7 In the event of a building evacuation because of NO_x, the ambient air concentration of NO_x shall be measured prior to allowing personnel reentry without SCBA. NO_x can be identified by its acrid odor and/or brown plume.

5.17.8 Gas sampling apparatus shall be vented back into the process off-gas line.

5.17.9 An air movement fan shall be used during work at the bottom of the CTS Pit.

5.17.10 An alarming NO_2 monitor shall be available at the melter lid to warn personnel of NO_2 levels above 1 ppm NO_2, during periods that nitrate containing materials are fed to the Melter.

5.17.11 Heavy duty heat resistant gloves and safety glasses are required for melter samples and other work with melter probes.

5.18 Operating Limits

The following limits define the window of operation for the SFCM. In the event that limit is exceeded, the Melter shall be placed in an idling mode until equipment operability is assessed.

5.18.1 The internal bulk glass temperature shall not exceed 1,300°C. Glass temperature can be inferred by Melter wall and electrode temperatures, if direct glass temperatures from thermocouple readings are not available. It is not the intent to feed the melter without glass contact thermocouples. Glass temperatures, (R1 and R2) are designated TT--201X and TT--202X, where X is a serial number 0 to 9. Wall temperatures, (M) are designated TT--204X.

5.18.2 The electrode temperature shall not exceed 1,150°C.

Bottom	electrode temperatures	TT--205X
West	electrode temperatures	TT--206X
East	electrode temperatures	TT--207X

5.18.3 A 01-14 blower shall exhaust the Melter when feeding frit or slurry. When nitrates are fed to the Melter, the NO_x scrubber system shall be operating with at least one NO_x monitor operating.

6.0 PROCEDURE/EQUIPMENT DESCRIPTION

6.1 Melter

Power is adjusted to maintain the bulk glass or average temperature in the range specified on the Run Sheet. The spatially averaged temperature TIX-2039, is electronically filtered to provide a time average as well. This final temperature is then used as the control parameter in the TIC-2031, the Circuit A controller. The other controllers, TIC-2032 and TIC-2033, are in cascade control slaved based on a ratio. The melter power is controlled almost exclusively from TIC-2031 either in Automatic with the temperature set point or in manual for such activities as melter shutdown. The SE shall authorize all power controller setting changes.

Melter temperature probes R-1 and R-2 each have 10 thermocouples for monitoring and control of the melter. Figure 9 shows the position of the thermocouples in the melter. The thermocouples are 1/8 inch Inconel sheathed, mineral insulated, and ungrounded. Type K thermocouples will be used in R-1 and type N in R-2. See appendix D for additional information on thermocouple and temperature control.

MELTER THERMOCOUPLE LOCATION

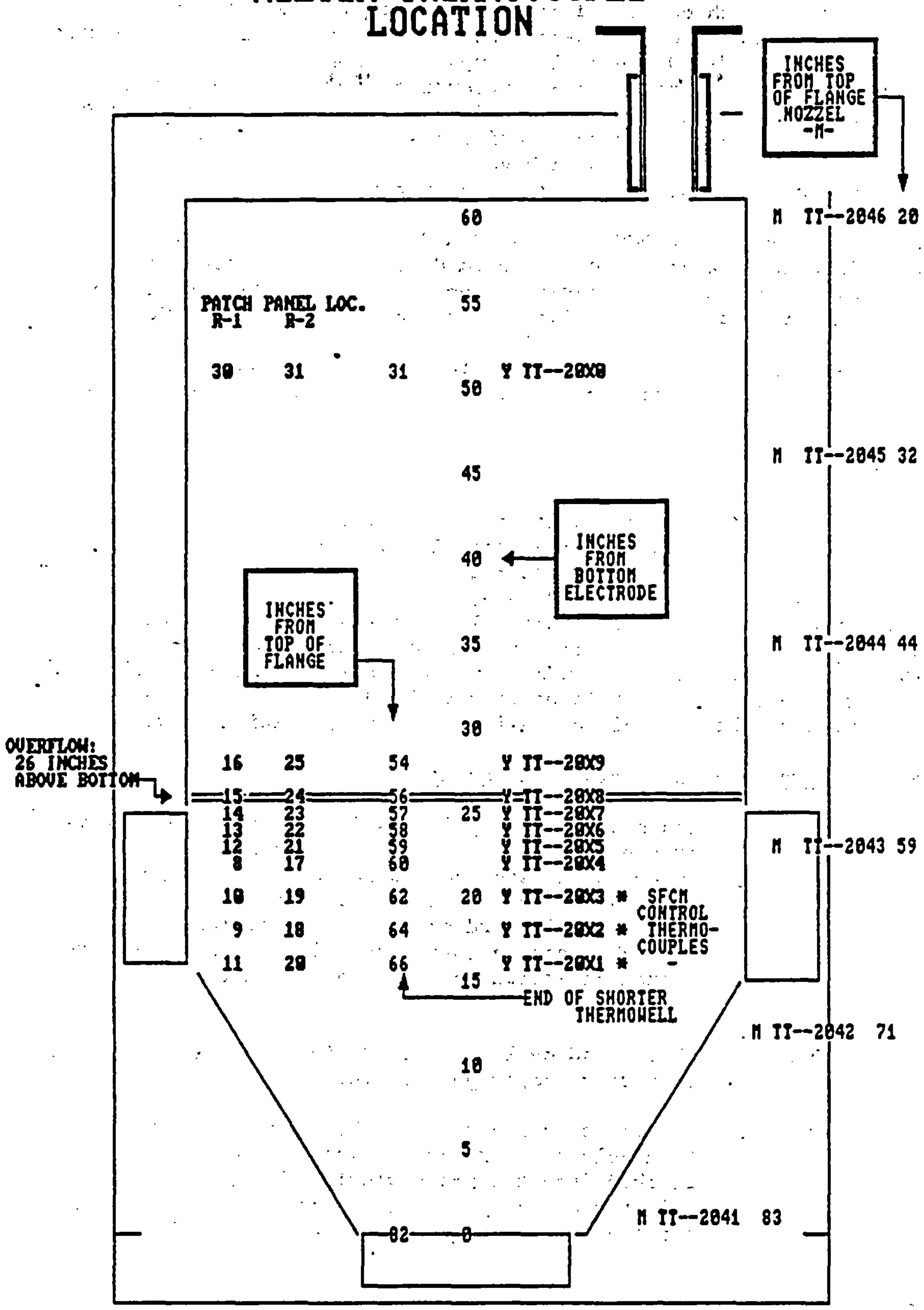


FIGURE 9

Power to the SFCM electrodes is supplied by three single phase transformers each connected to a different phase of the incoming 480V, three phase power. Each circuit, consisting of a transformer, SCR, and MICON P-200 controller, supplies power across two of the electrodes. The circuits are independent of one another, except that the SCRs may limit output at full power levels (at a particular transformer tap) to prevent interferences between the SCRs. Circuits are interlocked with high current, low SCR cooling flow, SCR temperature, and the power E stop button.

The operation of the DCS is covered under SOP 63-5, Rev. 1, Vitrification Operations Distributed Control System Procedure. Any changes to the melter temperature control configuration shall be described in the Vitrification Log, and co-signed by the VOSS.

A cup will be placed in the melter to collect any "second phases" which settle to the bottom of the melter. The cup will be retrieved after the run.

6.2 Turntable

The turntable is used to position the canister under the melter pour spout. The closed design also controls the air flow and process vapors venting them back to the melter. Reference canisters as used in SF-12 are described in WVDP-056, Description of the WVDP Reference HLW Form and Canister. The available reference canisters will be used during run. If more canisters are needed, spare PROCANS will be filled. PROCANS are an earlier version of the canister design, which will be used to hold the produced glass. They will not be part of any canister characterization work.

6.2.1 Turntable and Canister Movement

6.2.1.1 Index canisters by initiating the turntable drive at controller. Drive gearing slows canister movement at each node to facilitate alignment. Check alignment visually. The drive may be used in either the forward or reverse direction. The turntable can be moved manually with a wrench and wrench extension in the event the normal drive fails.

NOTE: Check load cell response during canister alignment to verify proper positioning.

6.2.1.2 The glass pour stream can be viewed from the turntable viewport and canister alignment can be checked from the hatch viewing flanges. Canister weight and identity shall be logged into and out of the the turntable in the operations log book.

6.2.1.3 If the turntable loadout port seal assembly is installed, fill turntable loadout port water seal as necessary. Seal level is monitored and controlled in the DCS at LT--4201. Water can be added from HIC-4201, Micon 3, Loop 4.

6.2.1.4 A filled canister will be changed out by rotating the canisters in the turntable when the mass balance calculation, and/or viewing mirror observation indicate that the canister is nearly full as directed by the shift engineer.

6.2.1.5 Target fill is 85 ±5 percent for all canisters.

6.2.1.6 SOP 63-4 covers the following procedures:

- o Turntable seals and positioning
- o Canister installation and retrieval
- o Carrousel rotation
- o Turntable cooling

6.2.1.7 Installation and retrieval of PROCAN canisters, when used, shall be rigged with minimum length 6 foot chokers. Three chokers with a minimum 3000 lb SWL each shall be used. Canisters were load tested at fabrication and will not require additional load testing prior to use.

6.2.1.8 Take shard samples of each canister per section 6.2.3.

6.2.2 Canister Characterization

Each reference canister shall be characterized before and after filling with data recorded on table 3, Canister Characterization Data Sheet. Separate sheets will be used before and after.

6.2.2.1 Record canister identification number.

6.2.2.2 Weight canister with the use of a dynamometer record weight and date of valid calibration tag.

6.2.2.3 Insert canister in canister Go-No Go gauge.

6.2.2.4 Measure and record micrometer depth readings from Go-No Go gauge to canister in both X and Y axis. Note and record micrometer number and date on valid calibration tag.

TABLE 3

CANISTER CHARACTERIZATION DATA SHEET

CANISTER IDENTIFICATION NUMBER: ______________

CANISTER CONDITION: (Circle One) PREFILL POSTFILL

CANISTER WEIGHT: ______________ DYNAMOMETER NUMBER: ______________

CALIBRATION DATE: ______________

CANISTER HEIGHT: 1) ______ 2) ______ 3) ______ 4) ______ Avg. ______

MICROMETER NUMBER: ______________ CALIBRATION DATE: ______________

______________ CALIBRATION DATE: ______________

______________ CALIBRATION DATE: ______________

______________ CALIBRATION DATE: ______________

AMBIENT TEMPERATURE: ______________

OPERATOR: ______________ DATE: ______________

"X" AXIS DIAMETER

Gage Position Inches from Top	Micrometer Readings X	Micrometer Readings X_1	Gage O.D. X Axis	Sum of Readings $(X + X_1)$	Canister O.D. x Axis [Gage O.D.-$(X+X_1)$]	Comments
5			25.786			
10			25.808			
15			25.821			
25			25.852			
35			25.819			
45			25.822			
55			25.847			
65			25.847			
75			25.875			
85			25.866			
95			25.848			
105			25.809			
115			25.792			

"Y" AXIS DIAMETER

Gage Position Inches from Top	Micrometer Readings Y	Micrometer Readings Y_1	Gage O.D. Y Axis	Sum of Readings $(Y + Y_1)$	Canister O.D. x Axis [Gage O.D.-$(Y+Y_1)$]	Comments
5			25.813			
10			25.828			
15			25.830			
25			26.115			
35			25.821			
45			25.829			
55			25.805			
65			25.779			
75			25.830			
85			25.825			
95			25.820			
105			25.797			
115			25.759			

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6.2.2.5 On the post fill characterization the glass shall be recorded on the Glass Height Data Sheet, table 4.

6.2.2.6 Request QC technician to take Ultrasonic Thickness (UT) measurements of canister wall. A thickness measurement will be made at each grid position, grids A through H as shown in figure 10.

6.2.3 <u>Shard Samples</u>

After a canister is full and it is removed from the Turntable, a shard sample shall be pulled from each canister. It is desired to sample the "As poured and cooled" surface of the can, so the sample must be pulled before the canister is tipped over for storage or transfer out of CTS.

6.2.3.1 A "Shop Vac" type vacuum cleaner shall be reserved for the purpose of sampling SF-12 canisters. The vacuum tub shall be cleaned, and a new filter installed.

6.2.3.2 Using the standard vacuum wand with a plain end, and a small piece of 20 to 60 mesh screen. Hold the screen in place with the vacuum, and suck up any available glass shards from the canister.

6.2.3.3 Transfer the screen and sample to a sheet of plastic, and turn off the vacuum to release the sample. Repeat as necessary to obtain sufficient sample, approximately 50 grams are required (20 to 50 mL volume).

6.2.3.4 Transfer the sample to "Zip-loc" sample bag, label, and record the sample per section 8.8.

6.2.3.5 If there is not enough loose material in the canister to collect the desired sample, break up the surface using a heavy (approximately 2 lb) object dropped from no more than 2 feet. Record details of any attempts to break up the glass in the log. Data will be helpful in designing a remote handled sampler.

6.2.3.6 Collect and weigh all of the materials in the shop-vac tub and filter. This can be done when all canisters are sampled for a per can average. Report in the log book.

TABLE 4

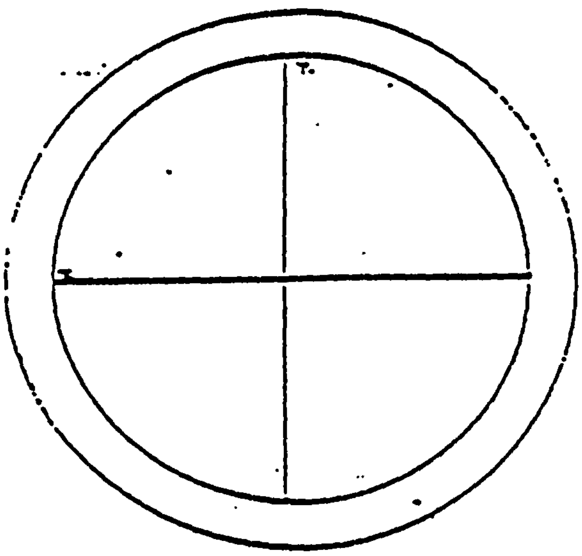
GLASS HEIGHT DATA SHEET

Canister Identification Number: ____________________

Canister Height: 1) __________ 2) __________ 3) __________ 4) __________ Avg. __________

Operator: ____ Date: __________

Shift Engineer Review: ______________

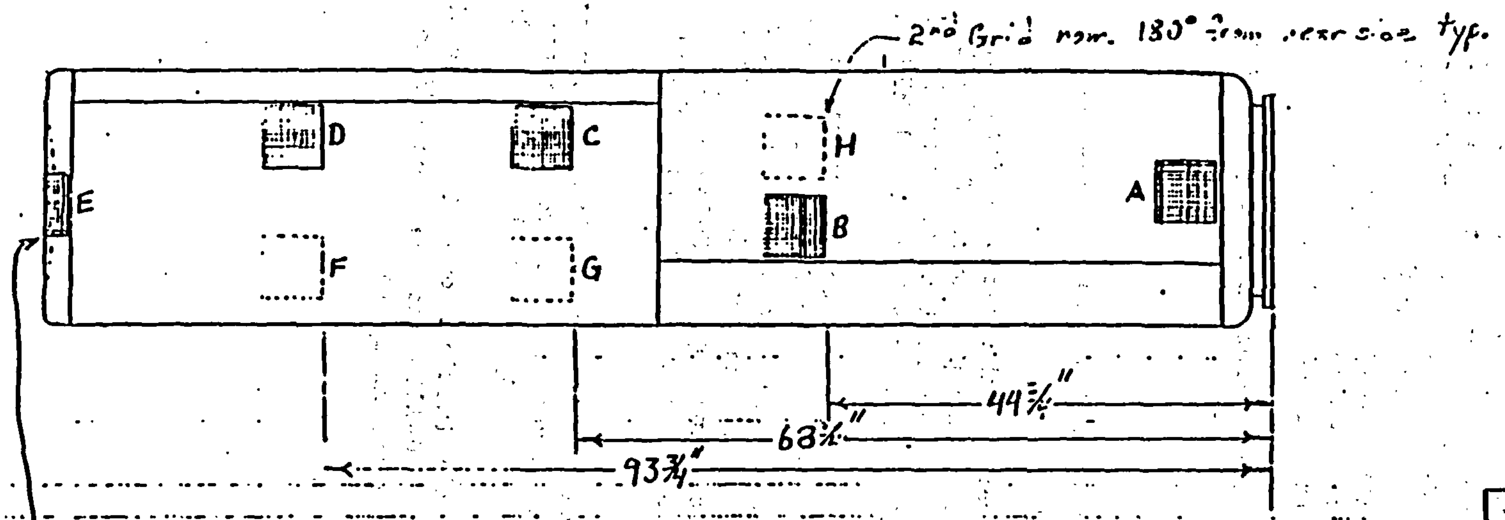


X-AXIS

Position From Outside Diameter of Canister	Distance From Top of Canister to Glass Surface (DT)	Height of Glass Inside Canister (Canister Avg. Height-DT)
X-1 (3.3)		
X-2 (6.9)		
X-3 (9.3)		
X-4 (12.0)		
X-5 (14.8)		
X-6 (17.9)		
X-7 (20.2)		

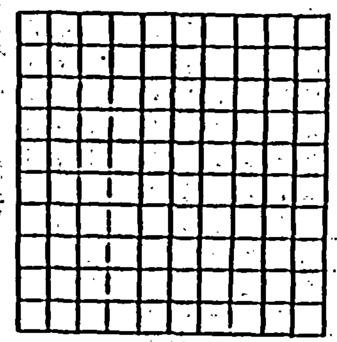
Y-AXIS

Position From Outside Diameter of Canister	Distance From Top of Canister to Glass Surface (DT)	Height of Glass Inside Canister (Canister Avg. Height-DT)
Y-1 (3.3)		
Y-2 (6.9)		
Y-3 (9.3)		
Y-4 (12.0)		
Y-5 (14.8)		
Y-6 (17.9)		
Y-7 (20.2)		



Locate grid adjacent to weld where applicable

Bottom head grid wraps around curve of head



GRID
½ to ⅝ inch squares

West Valley Nuclear Services Co. Inc.
West Valley, New York

TITLE	CANISTER THICKNESS Measuring Grid Layout
DATE 14 Jan 89	BY D.N. Zoet
CHK	1-11-89
SKETCH NO. SKDJP011489-1	SHEET 1 OF 1

6.3 Slurry Feed System

6.3.1 ADS Pump

Feed will be pumped from the MFHT to the SFCM by the Air Displacement Slurry Pump (ADS). Figure 11 shows the pump P&ID and flow diagram of the ADS pump system. The shift engineer will specify the flow rates. See appendix D for feed control strategy. The recycle mode back to the MFHT should not be used during the run.

The ADS pump is controlled from Micon 1. Loop 8 controls the air pressure as a manual loading station HIC--1135. The feed rate is accessible from the Loop 8 ratio. The pump is started from HIN-1131 and the water flush is initiated from HIN-1139. These water flush cycles shall be initiated as part of pump start-up and at least one flush cycle shall be initiated at ALL feed stoppages. This will help keep the pump and the feed nozzle free of plugs. The ADS pump operation may be controlled from graphic 075.

The pump shall be flushed during operation once per day as a minimum.

ADS Pump Operation

6.3.1.1 Start pump operation at HIN-1131 and set pump pressure at HIC-1147.

6.3.1.2 Set the ADS pump rate at the ratio of Micon 1, Loop 1, HIC-1147 in litre per hour. Set the bias to a factor to correct LT-1101 to the true level of the MFHT (i.e., LT-1101/bias = True Level MFHT).

NOTE: The bias should be set to the specific gravity of the feed to correct for level. However, effects such as the velocity head from the agitator and plugging has caused inaccuracies. The true level shall be determined by the periodic level determinations made with the agitators off and probes blown.

6.3.1.3 Use ADS flush cycle to cool the melter feed nozzle immediately before diverting feed to the melter. Flush for three cycles, by using HIN-1139 to flush.

NOTE: HIN-1139 will initiate one flush cycle when it is turned on. HIN-1139 must be shut off and back on to start a second cycle.

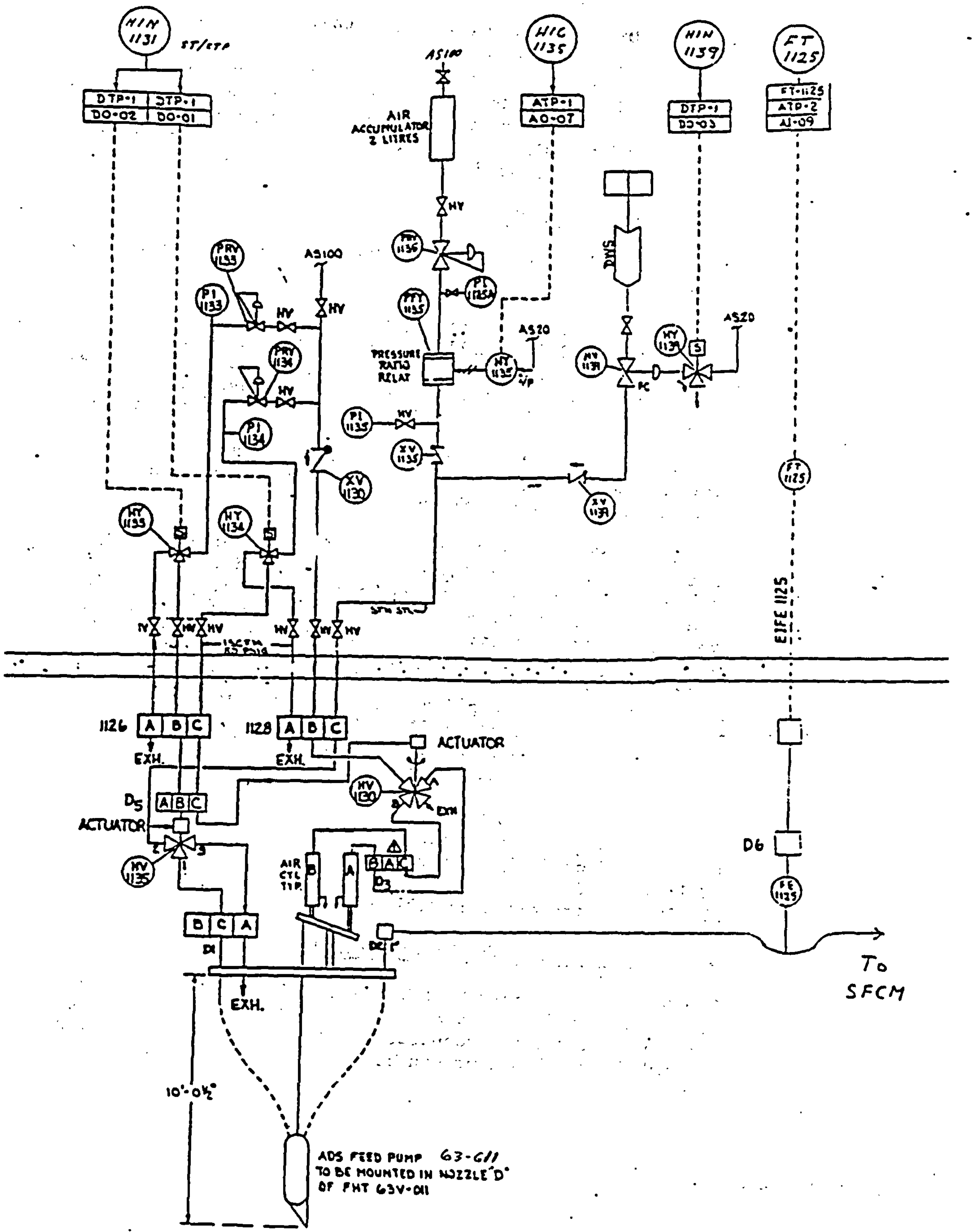

HIN 1131
HIC 1135
HIN 1139
FT 1125
AIR ACCUMULATOR 2 LITRES
PRESSURE RATIO RELAY
ACTUATOR
AIR CYL TYP.
EXH.
1126
1128
D5
D6
EIFE 1125
To SFCM
10'-0½"
ADS FEED PUMP 63-G11 TO BE MOUNTED IN NOZZLE "D" OF FHT 63V-011

Figure 11

6.3.1.4 Immediately turn the ADS pump on at HIN-1131. Verify flow at FT--1125, the magnetic flow meter.

6.3.1.5 Water flush the ADS pump by switching the pump off at HIN-1131 and using HIN-1139 to flush after the pump cycle is complete. Restart the pump at HIN-1131 after the flush is complete. Flush after any stoppage or as necessary for pump operation. If the plastic tubing at the pump appears brown or tan, a water flush should be started.

6.3.2 Melter Feed Hold Tank

The Melter Hold Tank, (MFHT) 63-V011 will be tested as a feed vessel.

The MFHT is a 10 foot diameter vessel. It stands approximately 10 feet tall, and it is supplied with an agitator and steam coils. The working volume of the vessel is 19,000 litres (5,000 gallons) which corresponds to approximately 100 inches of level or about 82 percent full.

The agitator extends to within 9 inches of the bottom of the tank, but a heel of 12 to 14 inches is necessary for appreciable mixing to take place.

To monitor the slurry level in the MFHT, several different instruments will be employed. The most reliable device so far in the testing program has been the simple purged dip tube. The purged dip tubes, however, can plug with slurry skewing the level signal and, thus, they must be blown down with air approximately every two hours. To be able to determine the current accuracy of the level, three independent sets of duplicate measurements will be recorded. In addition, a COSA diaphragm probe and a capacitance probe will be used to measure the level. The instrument numbers for the probe are as follows:

LT-1101 - Dip tube bubbler
LT-1102 - Capacitance probe
LT-1103 - Second dip tube bubbler
LT-1104 - COSA
LT-1105 - Third dip tube bubbler

6.3.3 Concentrator Feed Make-Up Tank (CFMT)

The Concentrator Feed Make-Up Tank (CFMT) 63-V001 will be operated as a feed concentrator. Start up and Operations procedures for the concentration are found in sections 7.8 through 7.10. The shutdown procedure is in sections 9.1 through 9.2.

The CFMT, constructed of Hastalloy C-22, is 10 feet in diameter, and approximately 14 feet tall. The operating capacity of the CFMT is approximately 19 000 L (5000 gallons) and a 3 785 L (1000 gallon) agitator heel.

The Agitation System consists of a 40 HP motor and two (2), 38 inch diameter Lightnin Model A310 axial-flow, high-efficiency impellers (three (3) blades each). The agitator motor is 40 HP, single speed (186 output rpm), with a 460 volt, 3 phase AC drive.

The CFMT has 4 equally spaced standard baffles, and 3.25 inch I.D. half-pipe heating/cooling jackets on the wall and bottom of the tank.

The CFMT utilizes a jet transfer system for feed transfer. There is also a separate heel removal jet which must be inserted in the agitator flange, if needed.

To monitor the slurry level in the CFMT, several different instruments will be employed. The most reliable device so far in the testing program has been the simple purged dip tube. The purged dip tubes, however, can plug with slurry skewing the level signal and, thus, they must be blown down with air approximately every two hours. To be able to determine the current accuracy of the level, three independent sets of duplicate measurements will be recorded. In addition, a COSA diaphragm probe and a capacitance probe will be used to measure the level. The instrument numbers for the probe are as follows:

LT-0101 - Dip tube bubbler
LT-0102 - Capacitance probe
LT-0103 - Second dip tube bubbler
LT-0104 - COSA
LT-0105 - Third dip tube bubbler

6.3.4 Slurry Level Probes

The following method shall be used to clear plugs from the purged level probes (not the COSA probes), referred to as blowing down the probes:

NOTES: 1) The CFMT pressure will shut down steam flow on high pressure, this is a likely occurrence when the probe for PT-0114 is blown.

2) The MFHT level sensors are open to atmosphere on the low pressure side. There are no purges or shutoff valves on this side.

3) The COSA probes, LT-1104 and LT-0104 are NOT to be blown.

6.3.4.1 Notify the control room that the probes are about to be blown down, and have the agitator turned off. The agitator off signals the DCS to ignore level readings for certain control algorithms (for example the DCS feed settings).

6.3.5 Shut off the isolation valve on the high side of the transmitter. This is either a separate valve or the valve in the three valve manifold. Shut off the lower pressure side isolation valve.

6.3.5.1 Increase purges to full flow for approximately 30 seconds.

6.3.5.2 Return the purge flow rates to normal.

6.3.5.3 Open low pressure side isolation valve.

6.3.5.4 Open high pressure side isolation valve.

6.3.5.5 Notify the control room that the probes have been blown, and that the agitator may be returned to service.

6.4 <u>CTS Off-Gas System</u>

6.4.1 Film Cooler and Melter Off-Gas Jumper

The melter off-gas jumper connects the melter to the SBS. At the melter, the film cooler fits into the melter nozzle to assist the transition from the high temperature melter environment to the water quenched SBS. The film cooler uses air to cool the gases and any particulate which could come in contact with the jumper walls and deposit. Cooled particulate does not deposit, but will be carried to the SBS.

For SF-12, the film cooler air supply may be augmented with a steam supply to adjust the humidity or water content of the off-gas. The steam is used as a convenient method to broaden the typical range of the operating parameters and enhance any potential effect on SBS efficiency.

<u>Steam Injection into the Film Cooler</u>

The plan is to inject steam into the film cooler approximately 10 times for approximately 1 hour duration each time to measure the effect of condensation on DF-SBS. The procedure will be to use flow rates (probably ~230 pph), start times, and end times as directed by the SE (probably ~1 hour duration).

- Verify 0 percent from controller (Micon 3 Loop 7), flow loop FIC-1110.

- Open the valve from the strainer at the film cooler. Crack open FV-1111 to heat the line to the film cooler and to blow out any debris that might otherwise plug the gaps in the cooler.

- Open the valve to the cooler and close the valve from the strainer. Increase the steam flow to the specified flow rate.

- When the steam injection is to stop, reverse the steps, including draining of the steam line through the strainer.

6.4.2 Submerged Bed Scrubber

The purpose of the Submerged Bed Scrubber (SBS) is to quench the steam and gases exiting the SFCM and scrub out the aerosols entrained in the gas system. The SBS consists of a bed of ceramic spheres submerged in a pool of water. Gas and steam from the Melter, laden with particles, are discharged beneath the bed where they are quenched while the remaining noncondensable gas flows upward through the bed. Air is injected into the Melter Off-Gas stream to increase the gas velocity to carry these particles all the way to the SBS. Cooling coils are provided to maintain fluid temperatures.

<u>Jet From SBS Bed to SBS Receiver</u>

- Obtain pre-jet sample of bed and receiver.

- Verify receiver level (LT-3111) is no greater than 0 inches. If not so, transfer liquid from receiver per VOSS instruction.

- Start the sparge air flow to the SBS bed using Micon 4 Loop 3, Control Loop FIC-3107. Adjust the air flow rate per the SE instructions (probably full open).

- After ~5 minutes of sparging, activate the jet as follows:

- Open steam valve to bed, close steam valve to receiver.

- Open valve from SBS bed to jet.

- Activate jet using HIN-3114 (Micon 6, Bonus Tag 1) until bed level (LT-3101) drops to 48 inches, then de-activate the jet.

- Refill the bed using HIC-3106.

- Repeat the jet activation/bed refilling as many times as directed by the SE (probably 4).

- Stop the sparge air flow.

- Obtain post-jet sample from bed and receiver.

- Close steam valve and valve from SBS bed to jet.

<u>Jet from SBS Receiver to CFMT</u>

- SE verify CFMT has sufficient available volume for the transfer. IF not so, transfer can not be done.

- Start the sparge air flow to the SBS receiver using Micon 6 Loop 2, Control Loop FIC-3116. Adjust the air flow rate per the SE instructions (probably full open).

- After ~5 minutes of sparging, activate the jet as follows:

    - Open steam valve to receiver, close steam valve to bed.

    - Open valve from SBS receiver to jet.

    - Close valve from SBS receiver to pump-out.

    - Activate jet using FIC-3107 until receiver level (LT-3111) drops to 0 inches, then de-activate the jet.

- Stop the sparge air flow.

- Close the steam valve and the valve from the SBS receiver to the jet.

6.4.3 HEME and HEPA

In the CTS, melter off-gas is first treated by the SBS and then enters the High Efficiency Mist Eliminator (HEME). The HEME will filter the off-gas to remove submicron particulate and aerosols. Condensed aerosols drain back to a temporary hold tank in the CTS pit. Particulate is retained on the filter element. Treated gases leaving the HEME are passed through a steam heater, a HEPA filter, and then transferred to the 01-14 Building via the off-gas transfer pipe.

Flush HEME

The HEME flush loop may be actuated during the run. The flush plan is to inject water into the HEME approximately 10 times using one of two volumes (probably either 80 or 160 litres) each time to measure the effect of flushing on DF-HEME. The procedure will be to follow flow volumes as directed by the SE.

- Verify the condensate is drained from the HEME. If not, drain it.

- Open the valve to direct water to the HEME and add the volume of water directed by the SE. Close the valve.

The HEME preheater is an electric heater installed in the inlet piping to the HEME. The heater will be operated per the SE in support of off-gas particulate sampling. The heater is enabled at HIN-3301 and controlled by TIC-3301, all on Micon 1. The heater is automatically shut off by low flow to the heater at FT-3401.

6.5 01-14 NO_x Treatment

6.5.1 01-14 Off-Gas Scrubbers

The two off-gas scrubbers are run in series to scrub NO_x from the pretreated SFCM off-gas. The primary scrubber is a packed bed scrubber and the secondary scrubber is a tray column scrubber. Operation of either unit is defined by whether the scrubber solution pumps are operating, circulating scrubber solution past the off-gas. Hydrogen peroxide, H_2O_2, solution, or water will be used to scrub the NO_x; as a result, nitric acid HNO_3 will be formed. The columns will be operated for at least 2 hours after completion of feeding nitrates to remove residual NO_x from the SFCM effluents.

Normally, both the primary scrubber, 63-C061, and the secondary scrubber, 63-C071, are operated with a hydrogen peroxide concentration between 1 and 9 percent. Changes to this may be made by the Shift Engineer to fit operating conditions.

During periods of higher NOx input to the scrubbers, such as high feed rates at startup, extra peroxide will be added to the primary scrubber, or both scrubbers to avoid depleting the peroxide.

Sampling frequency will be as described in the sampling section of the Test Instructions, Paragraph 8.9, table 7.

6.5.2 NO_x Monitors and Control

There are two monitors in the 01-14 building. Either of the monitors can be used to analyze for NO or NO_x. They are piped so that they can monitor either before the scrubbers, between the two scrubbers, after the scrubbers, or after the process blowers.

Since either monitor can be tracking the NO_x concentration, and the monitors may be shifted to the other positions, and other scales, the AIXs may read above 10 lbs/hr, at certain times. All shifts in monitor operation shall be noted in the log, so that the proper reading may be monitored.

The normal operation of the monitors shall be with at least one monitor analyzing NO_x, at the post scrubber position. The scale shall be on 250X (0 to 6500 ppm). This reading will be used together with the system flow rate (FT-6101) to calculate the amount of NO_x leaving the Vitrification process. This reading, AIX-6101 or AIX-6102, will display the NO_x in pounds per hour. An alarm is set at 8 lbs/hr to alert the operator that the effluent concentration is rising. If the NO_x level exceeds 10 lbs/hr for more than 15 minutes, the feed to the melter shall be shut down and steam to the CFMT shall be shut off until the system is brought under control.

A second limit is maintained to keep the NO_2 concentration below 2600 ppm. This limit cannot be exceeded if the NO_x is less than 8 lbs/hr. Melter feed and/or CFMT steam shall be shut down if this limit is exceeded, as above.

Normal control of the NO_x scrubbers involve keeping the peroxide concentration above 2 percent peroxide, and keeping the scrub solution pumps in operation. If control is not maintained, feed is stopped to allow the nitrate inventory to begin to deplete, while peroxide concentration, or scrub solution recirculation flow is restored. If the NO_x level exceeds 10 lbs/hr for any amount of time, the Vitrification Test Group Manager shall be notified. If 10 lbs/hr is exceeded for less than 15 minutes, normal day shift notification is acceptable.

Normal peroxide addition schedule shall be to add 2 drums of peroxide to the Primary Scrubber near the beginning of each shift. Peroxide is added to the secondary scrubber on an as needed basis, usually one drum every other day. Additional peroxide will be needed during startup as the feed rate and NO_x production is higher at these times. Also, the addition schedule may be modified based on periodic peroxide analysis during the run. Samples of the scrub solutions shall be taken approximately every 4 hours. Normally the first one will be taken an hour or two after the addition of the peroxide.

6.6 Off-Gas Blower

The Off-Gas Electric Blower is a rotary lobe, constant speed type with oil lubricated bearings and mechanical seals. The blower is driven by a 50 hp electric motor. It is capable of handling 1200 ACFM of gas (essentially air) at -120 inches WC

The Off-Gas Diesel Blower is driven by a 30 hp continuous, 43 hp peak Detroit Diesel Engine which is started by a 12-volt battery power supply. It, too, is capable of handling 1200 ACFM of gas (essentially air) at -120 inches WC. Either blower may serve to back-up the other blower in an emergency.

The Off-Gas Reheater is a shell (steam side) and tube (off-gas side) heat exchanger rated for a 47,000 Btu/hour duty. It will be required to heat the off-gas from (95°F) 35°C to (150°F) 65°C to prevent condensation. Outlet gas temperature control is accomplished by varying the steam flow to the Reheater shell by modulating Valve 64-TCV-3 located on the Steam Supply Line 01SL74-1-C-3.

Since the current process design is for approximately 800 ACFM gas flow at 150°F (65°C) (at Reheater outlet) and a -120-inch WC pressure, additional gas flow must be introduced to the blower suction to prevent the machine from producing a lower pressure (higher vacuum) than designed. This air makeup/suction pressure control is accomplished by control loop PIC-8101 (PIC-100). A pressure control butterfly valve increases or decreases the air makeup flow resulting in a corresponding decrease or increase of the pressure at the blower inlet.

6.7 Closed Loop Cooling Water System

The Closed Loop Cooling Water System includes a reliable means of supplying continuously circulating coolant to various users in the CTS. This system is intended to run continuously supplying the melter and melter power SCRs. Other users will draw cooling water from the system as necessary to operate these systems in support of CTS operation. The CLCWS Run Sheet will serve to keep the system configuration up to date.

CAUTION: A CLCWS flow (SCR coolant) is interlocked with the melter power supplies. Interruption of service will shut down power to the SFCM.

The following major equipment items comprise the system:

66-D10 Cooling Water Hold Tank
66-G10 Main Circulation Pump (Electric Driven)
66-G11 Spare Circulation Pump (Turbine Driven)
66-G12 Turbine Driver for Spare Circulation Pump
66-E10 Heat Exchanger

6.7.1 Normal System Lineup

6.7.1.1 The four manual hand valves on Instrument Racks 3A, 7A, 7B, and 8 downstream of the automatic control valves and branch connections for pressure relief valves are to be locked open.

6.7.1.2 Check that Valve GL-001 is cracked open to admit a small amount of warm up steam to the turbine while it is on standby. Do not allow a quantity of steam sufficient to turn the turbine to pass through the valve.

6.7.1.3 Check that the level in the hold tank has not dropped below the intended operating level of two-thirds full. If it has, make-up utility water should be added by opening Valve 66-GT-116.

CAUTION: IT WILL BE NECESSARY TO STOP THE PUMP TEMPORARILY SHOULD THE LEVEL FALL TO 6 INCHES ABOVE THE BOTTOM OF THE LEVEL GAUGE.

6.7.1.4 Check that CLCWS components and control loops are at their Run Sheet Values.

6.7.2 Operation

6.7.2.1 The electric driven cooling water pump is started or stopped from the motor starter in MCC-1 cabinet 3D. Hold start button in to build up pressure to close low pressure switch. Turbine pump will shut down automatically. The auto/manual switch is to be in the manual mode.

6.7.2.2 The turbine driven cooling water pump is started or stopped by operation of steam Valve FCV-041.

6.7.2.3 Pressure in the High Pressure Header is controlled by PIC-5836, which allows excess flow to return to the Hold Tank. Set at Run Sheet Value.

6.7.2.4 Pressure in the Low Pressure Header is controlled by PIC-5830, set at Run Sheet Value.

6.7.3 Alarm Response

Alarms are annunciated at the Melter Power Control Panel, and at the EMOA Panalarm for plant response.

6.7.3.1 High Pressure Header HIGH pressure: set point 55 psig

A) Readjust PIC-5836 to bring pressure within tolerances. See Run Sheet.

B) If both pumps are running, shut down turbine pump.

6.7.3.2 High Pressure Header - LOW pressure: Set point 20 psig

A) Readjust PIC-5836 to bring pressure within tolerances. See Run sheet.

B) If pump trips, restart pump or start alternate pump.

6.7.3.3 High Pressure Header - LOW-LOW pressure: set point 17 psig.

A) Steam turbine drive pump will be automatically started.

B) Turbine pump also starts on loss of electric.

NOTE: Loss of CLCW pumps will shutdown SFCM power.

6.7.3.4 Low Pressure Header - HIGH pressure:

Readjust PIC-5830 to bring pressure within tolerances. See Run Sheet.

NOTE: Individual users have pressure relief protection.

6.8 Instrumentation/Distributed Control System

The DCS is an integrated instrumentation system which ties the instrument racks to the control room. All control is done through the DCS with the exception of the 01-14 Building control. The DCS consists presently of 14 Micon P-200 controllers and 2 on-line, back-up spares. Each P-200 controller is a stand alone microprocessor based unit which can handle up to 16 analog inputs and 8 output or control loops. The P-200s are in constant communication with each other, a backup unit, and the central communicator. The communicator links the P-200s to the Control Room CRTs. The CRTs are convenient operation interfaces but are not necessary for system operation.

The DCS system provides the historical and alarm capability for the system. All process inputs are stored on magnetic disk on the DCS either through the P-200s or through the Tracer Data Acquisition System which is also sent to the central communicator. Operation of the DCS is covered by SOP 63-5.

6.9 IRTV

6.9.1 Equipment Description

The IRTV system is designed to give the operator a visual representation of various temperature regions on top of the cold cap of the SFCM. The equipment takes an image from the cold cap of the melter through a lens and mirror system. This reflected image of the cold cap is directed in the IR camera. The camera records the image and sends it to the color monitor. Before the image reaches the color monitor it is colorized. This process takes the image from the camera and assigns colors to particular light intensity bands which are proportional to temperature. Thus, if the color green was assigned to the temperature range between 500°C and 600°C, all areas of the cold cap in that temperature range would be green on the color monitor.

There are four sets of components that make up the IR camera system. They are:

1. The periscope
2. The wall plug
3. The IR camera
4. VIDEO Processing components
   a. The VP-8
   b. PCM-514 color monitor
   c. The color encoder
   d. The VHS recorder

The function of each component is listed below.

	Component	Function
1.	Periscope	Sits inside the nozzle of the SFCM and views the cold cap through a lens system; it directs the view of the cold cap toward the camera.
2.	The Wall Plug	The plug fits in the cell shield wall and provides an optical path from the periscope along a series of mirrors to the IR TV camera. The mirrors give the "radiation bend" through the wall. The plug weighs 3200 pounds primarily from the lead shielding used to compensate for the loss in concrete in the wall. The wall plug is used in FACTS to simulate the final radioactive configuration.
3.	The IR Camera	This sits outside the cell wall at the end of wall plug and records the image of the cold cap. It converts the visual image to an electronic signal and sends the signal to the control room.
4.	VP-8 Image Analyzer	Sits in the CTS control room and receives the signal from the IR camera. It takes the IR camera signal and codes the temperature regions of the SFCM cold cap with an assigned color.
5.	PCM-514 Color Monitor	It is located in the CTS control room and displays a visual image of the colorized SFCM cold cap.
6.	The Color Encoder	It is located in the control room of the CTS. It converts the image analyzer colorized signal to a composite signal. This allows the signal to be recorded by conventional video recorder.

	Component	Function
7.	VHS Recorder	It sits in the CTS control room and records the colorized video image of the cold cap on tape.
		Components of the IRTV system require the following utilities:
8.	Character Generator	Available for use in the control room to add messages and/or labels to a video signal.

	Component	Utility
1.	Periscope	Two 1/2" air line (instrument air) 1. Air supply at approximately 4 SCFM to the optics and aperture FIC-2040, Micon 2, Loop 4 2. Air supply at approximately 20 SCFM to the body FIC-2041, Micon 2, Loop 4. 3. Steam 10 - 30 second burst of steam to clean aperture.
2.	Wall Plug	None
3.	IR Camera	120volts/15Amp outlet
4.	VP-8 Image Analyzer	120volts/15Amp outlet
5.	PCM 514 Color Monitor	120volts/15Amp outlet
6.	Color Encoder	120volts/15Amp outlet
7.	VHS Recorder	120volts/15Amp outlet

6.9.2 Periscope Cooling

The IRTV periscope has two cooling supplies, and a steam supply to clean the periscope aperture. The steam burst is activated from the DCS, Micon 2 at HIN-2042. There will be an automatic 90 second burst of steam every hour followed by a continuous air purge. The first cooling circuit FIC-2041, cools the main body of the periscope. The air from this system exhausts to the "cell" at the melter lid. The second cooling circuit cools the lower optical elements in the periscope. The air passes by the lenses and enters the melter through the periscope aperture. This second cooling supply will be run in manual mode only. If the air is lost and cannot be restarted and the plenum temperature reaches 800°C, the camera should be removed.

Camera

The components of the IR camera have a certain level of adjustment. Each of the electronic modules, image analyzer, color monitor, color encoder, will refine the output image on either the monitor or VHS recorder. The shift engineer will adjust all instrumentations except for the VP-8 Image Analyzer.

The VP-8 Image Analyzer receives a signal from the camera and processes it to colorize the image by temperature. The method of setting the code involves adjusting the intensity and color control knobs while observing a set temperature source.

A connection diagram of the IRTV system hook-up is included as figure 12.

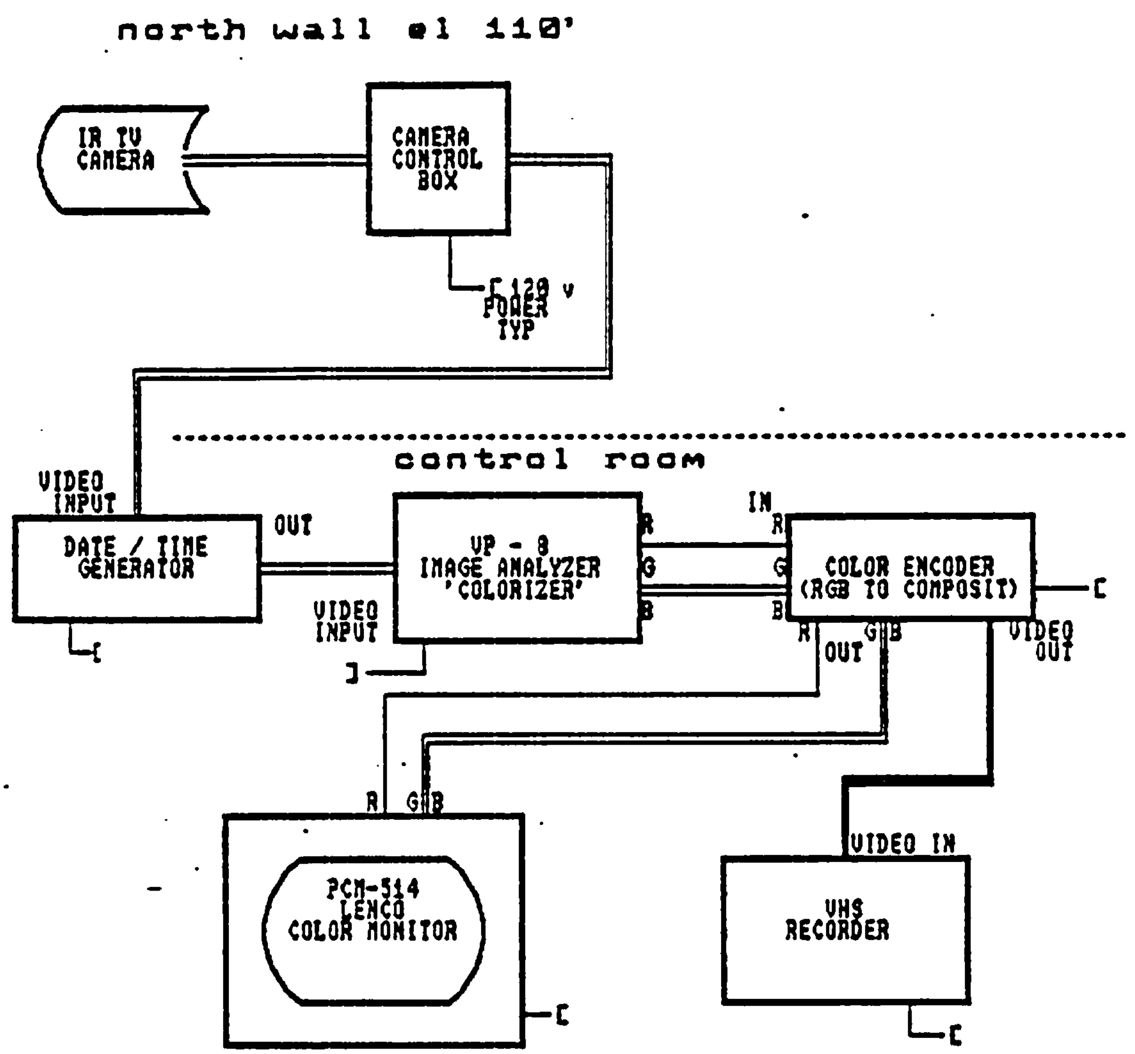
7.0 SYSTEM OPERATION-PREREQUISITES TO FEEDING MELTER

Sections 7.1 through 7.7 are the operational checklists that should be followed in preparing the melter for feeding. Sections 7.8 through 7.10 contains the operational checklists that should be followed in preparing to boil solution in the CFMT. Completed checklists should be retained and submitted to MRC per Paragraph 10.4. Exceptions to this checklist may be made by the Shift Supervisor and the Shift Engineer. Each exception shall be noted in the checklist and signed by the Shift Supervisor and Shift Engineer.

7.1 Melter Preparations

The following preparations should be accomplished prior to establishing melter vacuum.	Completed By
7.1.1 Nozzle "E" overpressure assembly is attached and tested for operability.	____________
7.1.2 Cooling water flow is at run sheet value.	____________
7.1.3 Film cooler and off-gas jumper are ready for installation. This includes gaskets, free nuts, antisieze compound and rigging for placing in the melter.	____________

IRTV VIDEO CONNECTIONS



ALL CONNECTIONS MADE WITH COAX CABLE

FIGURE 12

Completed By

7.1.4 Sufficient melter control thermocouples are operational and bulk glass temperature is being controlled in automatic by the DCS at run sheet set point. ____________

7.1.5 Discharge heaters functioning normally at idle. ____________

7.1.6 Air lift assembly installed and visually checked satisfactory. ____________

7.1.7 Melter level probes and bubbler installed and operational. ____________

7.1.8 Obtain Inconel Solids cup from cognizant engineer, and the cup handling tool. ____________

7.1.9 Electrode cooling system at run sheet value. ____________

7.1.10 Refractory cooling air at run sheet values. ____________

7.1.11 Viewports to be used are clean. ____________

7.1.12 All unused nozzles are provided with covers and bolted down. ____________

7.1.13 Video system ready to install to monitor glass surface. ____________

7.1.14 Bulk glass samples taken per sample schedule. ____________

7.1.15 Melter feed systems set-up. ____________
Open ADS pump demin water supply valve.

7.2 CTS Off-Gas Preparations

The following preparations should be accomplished prior to establishing melter vacuum.

Completed By

7.2.1 Off-gas jumper from SBS to HEME installed, gasket installed, and all bolts tightened. ____________

Completed By

7.2.2 Verify remainder of off-gas piping is visually installed and intact. ________

7.2.3 SBS bed is filled. (From Rack 2, Micon 4, Loop 4) ________

7.2.4 SBS bed and receiver cooling water flow is set per run sheet. ________

7.2.5 Trench off-gas pipe has been pumped dry and sampled per the sampling plan. ________

7.2.6 A dry HEPA filter has been installed in the HEPA housing. ________

7.2.7 Align steam to preheater through PCV-3611 and TIC-3611 (MICON 1 LOOP 6) as follows:

- crack open TIC-3611 in manual to establish steam flow and warm lines. ________

- place TIC-3611 in automatic and adjust set point to run sheet value.
  NOTE: The PV will not properly respond until an off-gas flow has been established. ________

7.2.8 HEME drain system set up, drum less than 50 percent full and carboy seal established. ________

7.2.9 Particulate sampling probes installed; alternatively, isolation valves in closed position. ________

7.3 <u>Turntable Preparations</u>

The following preparations should be accomplished prior to establishing melter vacuum.

7.3.1 Canisters to be filled installed; locations noted in log. ________

Completed By

7.3.2 First canister to be filled under pour spout; sampling bellows installed and clamped in place. ________

7.3.3 Pour stream viewing mirror in place and adjusted. ________

7.3.4 Cooling water flow established per the run sheet. ________

7.3.5 If the loadout port seal assembly is installed, water seal is filled. (From Rack 8, HIC-4105, Micon 3, Loop 4.) Seal level is monitored on DCS at LI-4101. ________

7.4 01-14 Off-Gas System Preparations and Startup

The following systems should be placed into service only after prerequisites above have been completed (with authorized exceptions noted by the Supervisor and Shift Engineer). The sequence of starting the scrubber recirculation pumps in relation to the off-gas blowers should be as specified by the Supervisor. NOTE: The NO_x Analyzer can be warmed up before starting this procedure per SOP 63-3.

Blower Startup

7.4.1 Energize power to the electric blower. Breaker is located in Main Plant Switch gear room, MCC-1, and is labeled "42001-1 off-gas blower, iodine building". ________

7.4.2 Request the UR operator to place the demineralized water pump in service for blower cooling. ________

7.4.3 Initialize the NO_x analyzer system warm up per SOP 63-3. ________

7.4.4 Verify that the 32 gallon fuel day tank is at least 85 percent full. ________

If not, follow the procedure below in filling: Prior to filling blower fuel tank, verify fill valves to CSS diesel fuel tank are all shut. If not, notify the Supervisor prior to proceeding.

Fill Procedure

1) Open fill Valves FO-1, FO-2 and FO-3. ____________

2) Verify closed Valves FO-4, FO-5, and FO-6. ____________

3) Request UR operator start fuel transfer pump. ____________

4) Monitor level indicator. Be prepared to close FO-1, FO-2, and FO-3 as soon as the level reaches 85 percent. Fill valves closed. ____________

5) Verify, out on roof, that tank did not overflow (check vent lines) ____________

6) Notify UR operator that you are no longer in need of fuel pump. ____________

7.4.5 Verify that the valve line-up is in accordance with the "Initial Valve Line-up Sheet", table 5. This line-up allows starting of either off-gas blower in lead with the second in automatic start standby.
Initial valve line-up verified. ____________

7.4.6 Place the hand switch adjacent to relay box K-1-RP-1 (southwest corner of fourth floor) in the "ON" position. ____________

7.4.7 Confirm cooling water flow through both blower lube oil coolers. Verification can be made by visual indication of the bullseyes and/or by feeling the lines for coolness. If there is doubt, contact the Supervisor.
Flow is confirmed. ____________

7.4.8 Verify that the lube oil level for both machines are in the mid range. ____________

TABLE 5

INITIAL VALVE LINE-UP SHEET

Valve Tag No.	Valve Description	Position
6-64-BU-132	HEPA Filter 64-B05B outlet	Closed
6-64-BU-133	HEPA Filter 64-B05A outlet	Closed
6-64-GT-146	Makeup Air Intake inlet	Open
6-64-GT-134	Diesel Blower 64-K02 discharge	Open
6-64-GT-135	Electric Blower 64-K01 discharge	Open
6-64-GT-137	Electric Blower 64-K01 casing drain	Closed
6-64-GT-140	Diesel Blower 64-K01 casing drain	Closed
6-64-GT-024	Blower Injection D.W. inlet	Closed
6-64-GT-120	Cooling Water Supply	Open
6-64-GT-136	Electric Blower 64-K01 C.W. inlet	Open
6-64-GT-138	Electric Blower 64-K01 C.W. outlet	Open
6-64-GT-119	Cooling Water Return	Open
6-64-GT-141	Diesel Blower 64-K02 C.W. inlet	Open
6-64-GT-139	Diesel Blower 64-K02 C.W. outlet	Open
6-64-GT-122	Reheater steam supply isolation	Closed
6-64-GT-125	Reheater Steam inlet	Open
6-64-GT-124	Reneater Condensate outlet	Open
6-64-GT-121	Reheater Condensate Return isolation	Closed
6-64-GT-148A	Electric Blower 64-K01 D.W. inlet	Closed
6-64-GT-148B	Diesel Blower 64-K02 D.W. inlet	Closed
6-64-GT-152	4th Floor DOP Test Connection	Closed
6-64-GT-128 thru -131	3rd Floor Filter Housing Actuators	Closed
6-64-GT-149 thru -151, -153, -154	3rd Floor Filter Housing Sample/Test Connections	Closed

Completed By

7.4.9 Open both blower casing drain valves, observe water flow, if any. Shut both valves when the casings are drained. Place TDIC-8801 in manual at 0 percent output.

7.4.10 Verify diesel blower is ready for operation:
- o Governor hand jack in "Run" position
- o Battery charger readings normal (>12 volts, 2.5 Amps)

7.4.11 Input a preliminary initial setting for PIC-8801 at valve position "V" of 28 percent (closed) in the manual mode "M".

7.4.12 Open the demineralized water supply Valve GT-024 and blower injection Valve GT-148A or GT-148B for the lead blower.

7.4.13 Open the 8 inch blower outlet valve in the main plant stack and close the drain valve.

7.4.14 Start the selected blower (per Supervisor's direction) by placing the standby blower selector switch in the "OFF" position and the lead blower selector switch in the "AUTO" position.

7.4.15 Verify lube oil pressure is running at least 10 to 12 psig and that the operating oil level is in the mid range. If either condition is unsatisfactory, stop the blower and contact the Supervisor. NOTE: When starting a "cold" blower, oil pressures will be higher until oil temperature warms up.

7.4.16 Place the standby blower in the "AUTO" position.

7.4.17 Test the auto start feature of the standby blower by placing the lead blower selector switch in the "OFF" mode. Verify the auto start satisfactory.

Completed By

7.4.18 Verify that the lube oil pressure and level on the standby blower is satisfactory. __________

7.4.19 Restart the lead blower and place standby blower back in automatic standby. (Stop running blower and restart primary blower per 7.4.14.) __________

7.4.20 Notify the Supervisor that the blower is ready to be placed into automatic pressure control on PIC-8801. When directed, place lead blower into automatic. __________

7.4.21 Set blower injection cooling water Controller TDIC-8801 in manual at approximately 15 percent output. __________

7.4.22 Align steam to the reheater by opening Valves GT-122 and GT-121. Set TIC-8101 to 65°C in automatic. Verify that the steam flow is established. __________

7.4.23 Contact CTS for coordination of opening butterfly Valve BU-132 or BU-133. __________

NOTE: 01-14 Building Alarm panel settings and responses are listed in table 6.

7.4.24 When directed by the Supervisor, calibrate and place the NO_x analyzer on-line per SOP 63-3. Place the sample position as requested by the Supervisor. __________

Scrubber Column Startup

7.4.25 Record levels in all surge and storage tanks. See Paragraph 8.11.

Prim. Surge __________ Sec. Surge __________

Prim. Storage __________ Sec. Storage __________

NOTE: Normal starting level in each surge tank is 16 to 18 inches.

TABLE 6

01-14 ALARM RESPONSES

Tag	Setting	Remarks
TAH-8101 TAL-8101	165°F 145°F	Temperature of off-gas exiting the reheater. Indication is likely a result of maloperation of steam supply or condensate removal from the reheater.
PAH-8101 PAL-8101	-120 in W.C. - 50 in W.C.	Highest and lowest anticipated negative pressure at reheater off-gas outlet.
PDH-8601 PDH-8701	3 in W.C. 3 in W.C.	HEPA Filters 64-B05A and B pressure differential. Indication signals switch over to other HEPA filter required.
PAH-8801 PAL-8801	-125 in W.C. - 60 in W.C.	Highest and lowest permissible negative blower inlet pressure.
TDH-8810	45°F	Initial warning the blower temperature differential has increased.
TDHH-8801	50°F	Secondary warning the blower temperature differential has continued to increase.
TH-164	180°F	Hi blower discharge temperature can result from hi blower inlet temperature or a malfunction of Control Loop 148.
PH-121	25 in W.C.	Hi blower discharge pressure.
FL-159	0 fps	Indicates total loss of cooling water to both blower oil coolers.
IH-109	58 amps	Warns of impending trip of electric blower MCC at _60 to 61 amps. This alarm is related to blower suction pressure setting via PIC-100 (i.e., higher vacuum pressure settings require more amps to the blower motor).
PL-154	9 psig	Warns of electric blower low lube oil pressure (check level).

TABLE 6 (CONTINUED)

01-14 ALARM RESPONSES

Tag	Setting	Remarks
PLL-154	6 psig	Warns of continued electric blower low lube oil pressure. Blower should be shut down in coordination with CTS operations if unable to correct the problem.
PC-1	-40 in W.C.	Time delayed critical low vacuum trip of electric blower.
TH-155	205°F	Diesel blower engine high water temperature.
PL-152	9 psig	Warns of diesel blower low lube oil pressure (check level).
PLL-152	6 psig	Warns of continued drop of diesel blower low lube oil pressure. Operator should shut down and switch over to electric blower if oil pressure drops to 5 psig.
SH-153	1300 rpm	Advises of diesel blower trip due to motor governor overspeed.
PL-151	10 psig	Diesel blower motor low oil pressure.
TSH-152	120°F	Warns of high discharge lube oil temperature from lube oil cooler on the diesel blower. Vendor recommends 120°F maximum temperature.
TSH-154	120°F	Warns of high discharge lube oil temperature from lube oil cooler on the electric blower. Vendor recommends 120°F maximum temperature.

Completed By

7.4.26 Verify cooling water flow to the primary and secondary coolers through TRC-1 and TRC-2 is 100 percent. ______

7.4.27 Verify all purges are set to 1.5 SCFH. ______

NOTE: Both scrubber pumps should be started as indicated below, however the sequence is not specified.

7.4.28 Verify that the primary scrubber recirculation pot level Controller LRC-1 is in automatic with valve set at 40 percent. ______

7.4.29 Verify that all suction valves to the pump are open, then start the primary recirculation pump. Ensure seal water is valved into the pump shaft seal. Adjust pump discharge valve until LRC-1 takes control of flow, then OPEN discharge valve fully. ______

7.4.30 Verify that the secondary scrubber recirculation pot level controller in automatic with valve set at 40 percent. ______

7.4.31 Verify that all of the suction valves are open, then start the secondary recirculation pump. Ensure that the seal water is valved into the pump shaft seal. Adjust pump discharge valve until LRC-2 takes control of flow, then OPEN discharge valve fully. ______

7.4.32 After liquid circulation is stabilized, watch the primary and secondary column differential pressure for instability. ______

7.4.33 Scrub Solution Disposition

As solution accumulates in the two surge tanks, solution is transferred batchwise to the Collection Tanks. Solution in the collection tanks can be neutralized per step 7.4.34 or sent to either the CFMT or Temporary Cold Chemical Tank under direction of the SE or VOSS. ______

NOTE: Solution must be neutralized if it is to be transferred to any tank other than V-01, V-11, V-31, the main mix tank, or the shim tank.

7.4.34 Neutralization

Neutralization can be done in any of the scrub solution or Temporary Cold Chemical vessels under direction of SE or VOSS.

7.4.34.1 50 percent caustic solution from the Caustic Storage Tank is used to neutralize. Caustic may be transferred to the 01-14 Building in a covered vessel and set to drain or pump by chemical hose through a spare connection in the Primary Collection Tank. When caustic is used in the TCC, it will be transferred and used per SOP 65-02.

7.4.34.2 Solution in the tank to be neutralized is sparged with air for 10 minutes.

7.4.34.3 Sample the tank from the B-sampler for that vessel.

7.4.34.4 Analyze for acid molarity and/or pH per the instruction in SOP 02-3.

7.4.34.5 Add caustic to tank per the following formula:

$$\text{Litre of caustic:} = \frac{(\underline{M}\ \text{acid})\ (\text{volume of solution})}{(\text{molarity of caustic used})}$$

or per direction of SE or VOSS.

NOTE: 50 percent caustic is approximately 19 molar.

7.4.34.6 Sparge tank following caustic addition for 10 minutes and resample and measure pH as above. pH to be between 3 and 11 before transfer. Insert the final pH in Log Book.

7.5 Establish Melter Vacuum

The following procedure should be accomplished only after steps above have been completed or deviations authorized on this check sheet by the Supervisor and Shift Engineer.

Completed By

NOTE: To avoid system interaction with the Scale Vitrification System, the SFCM cannot be in a slurry feeding mode while the SVS-II melter is valved into the same process off-gas system.

7.5.1 Verify that all purge meters in CTS are properly set as specified by the Supervisor. ______

7.5.2 Verify that the air injection and film cooler air supply systems are ready for operation. Visually check the supply hoses from supply racks to the melter front area. ______

NOTE: Under normal conditions the film cooler should not be installed in the melter for over one hour without an airflow.

7.5.3 Install film cooler in melter. ______

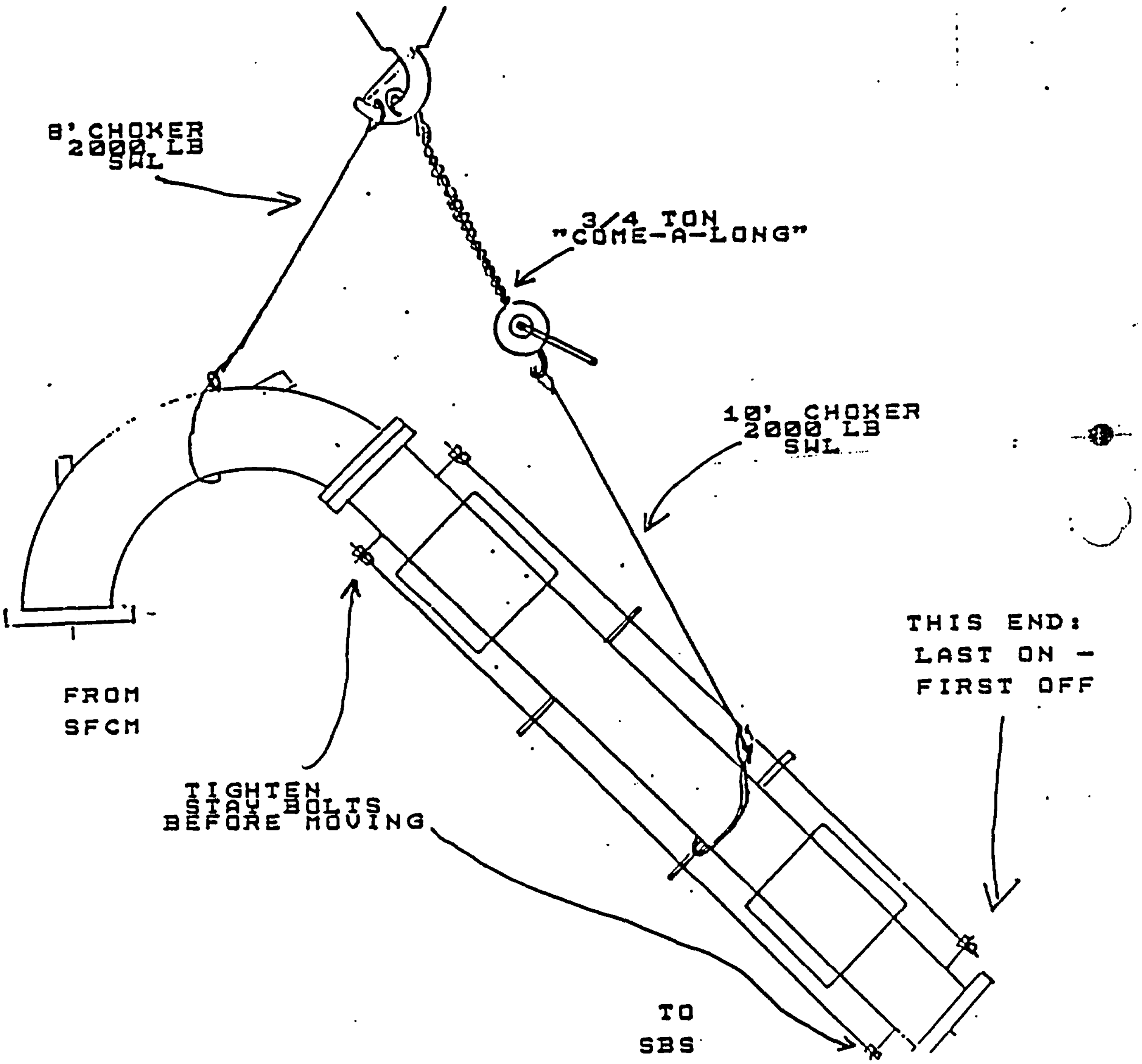
7.5.4 Install melter off-gas jumper between the SBS gooseneck and the melter film cooler. Use lifting sketch in figure 13 for rigging the jumper. ______

7.5.5 Control room operator establish communications with the operator in control of valving in off-gas system to the melter. Check PV Alarm on PIC-2004 (Micon 6, Loop 5) is set at +1.0 inches W.C. and that XMTR Alarm on PT-2004 (Micon 6, Input 5) is set at +0.5 W.C. ______

7.5.6 Verify blower vacuum control PIC-8801 is in automatic and set to between -100 and -110 inches W.C. prior to valving in the melter. ______

7.5.7 Slowly valve in the melter to the off-gas system. Do not exceed -10 inches W.C. during this step. This can be controlled by throttling the butterfly valve at the blower discharge HEPA, BU-132, or BU-133 or in the system isolation valve upstream of the HEME. ______

SFCM OFF GAS JUMPER LIFTING ARRANGEMENT



FIGRUE 13

Completed By

7.5.8 Set melter pressure control loop to between -1 inch and -5 inches W.C. in automatic, thereby establishing air injection flow. ____________

7.5.9 Slowly establish film cooler air flow in manual, raising it to run sheet value. Watch PIC-2004 control during this step for problems. ____________

7.5.10 Adjust alarms on melter pressure control loop to: "High" = -1.0 inches W.C. and "High-high" = -0.5 inches W.C. ____________

7.5.11 Verify that the pressure tap to the off-gas jumper for PT--3102 is connected. ____________

7.5.12 Verify that the thermocouples on film cooler and off-gas jumper are operable (TT-2006, TT-2007). ____________

7.5.13 Adjust the control limits at the discharge heater controls to keep discharge section warm. ____________

7.5.14 Check the CTS off-gas system for inleakage and correct.

- o In line off-gas sampling probes ____________
- o SBS ____________
- o Turntable ____________
- o Melter ____________

7.5.15 Increase discharge heater output to run sheet values. ____________

7.5.16 Place the HEME heater in operation (if required by Supervisor and Shift Engineer) as follows:

NOTE: The HEME Preheater must be shut off if there is a loss of off-gas flow.

Completed By

- verify 0 percent output from controller (Micon 1 Loop 7) ________
- close power supply breaker (south wall) ________
- close breaker at MCC #1, Breaker 3C ________
- turn off discrete HIN-3301, Micon 1 ________
- increase power output from controller to run sheet value. Place in automatic control. ________
- verify proper operation of HEME heater. ________

7.5.17 Insert sludge cup in melter.

- Check CTS IWP for Melter work, and Power Melter down per Vitrification Standing Instructions. ________
- Insert the Cup on the bottom of the melter pool below Nozzle "A"; slowly lower the cup down nozzle "A" with the cup centered in the nozzle and the tool oriented to the North. ________
- With the cup on the bottom electrode, slide the tool off the cup by drawing it north and removing the tool. Return power to the Melter. ________

7.6 IRTV Installation

The periscope will be installed in SFCM nozzle B (V-20-B) in the following sequence:

1. Remove the periscope from the storage/shipping box and locate above nozzle B using the rigging shown on sketches SKDJP 110188, 1 and 2, figures 14 and 15. The person in charge will be the shift supervisor.

2. Install a type K thermocouple in the periscope thermowell (72 inch minimum length) and connect to the Patch Panel at No. 6. Verify response on DCS TT-2000. ________

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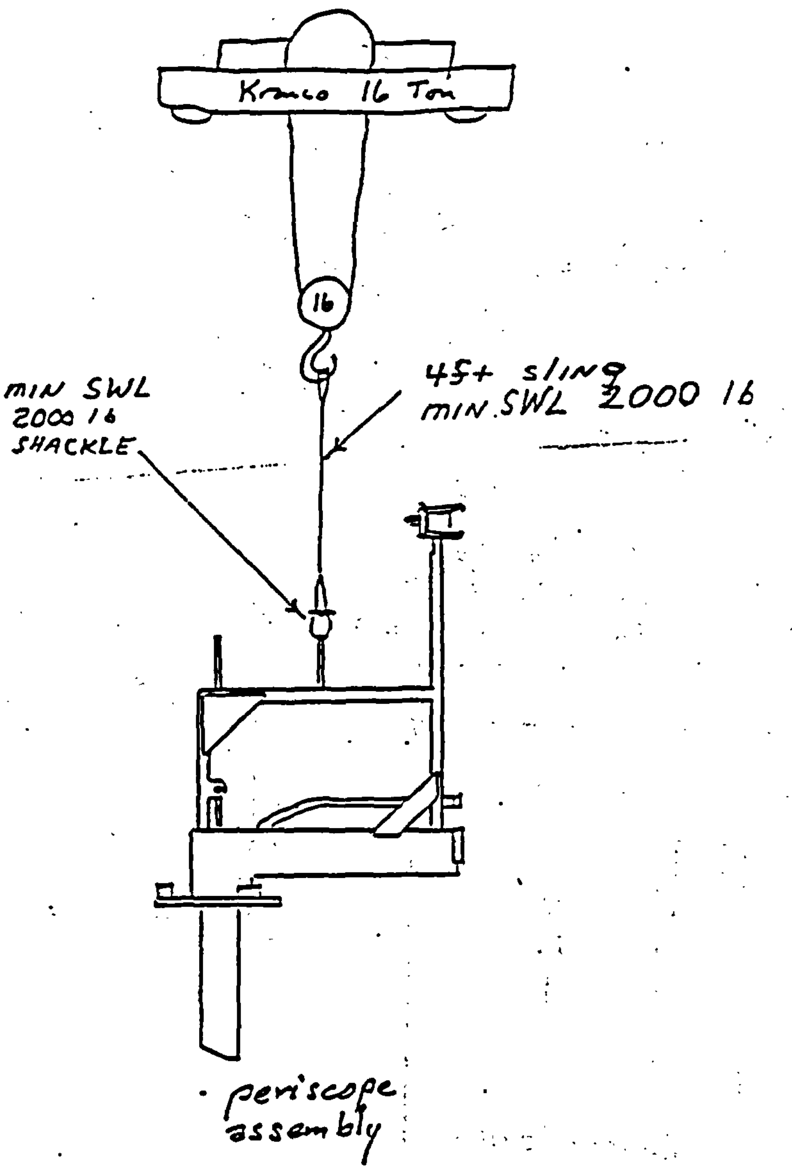
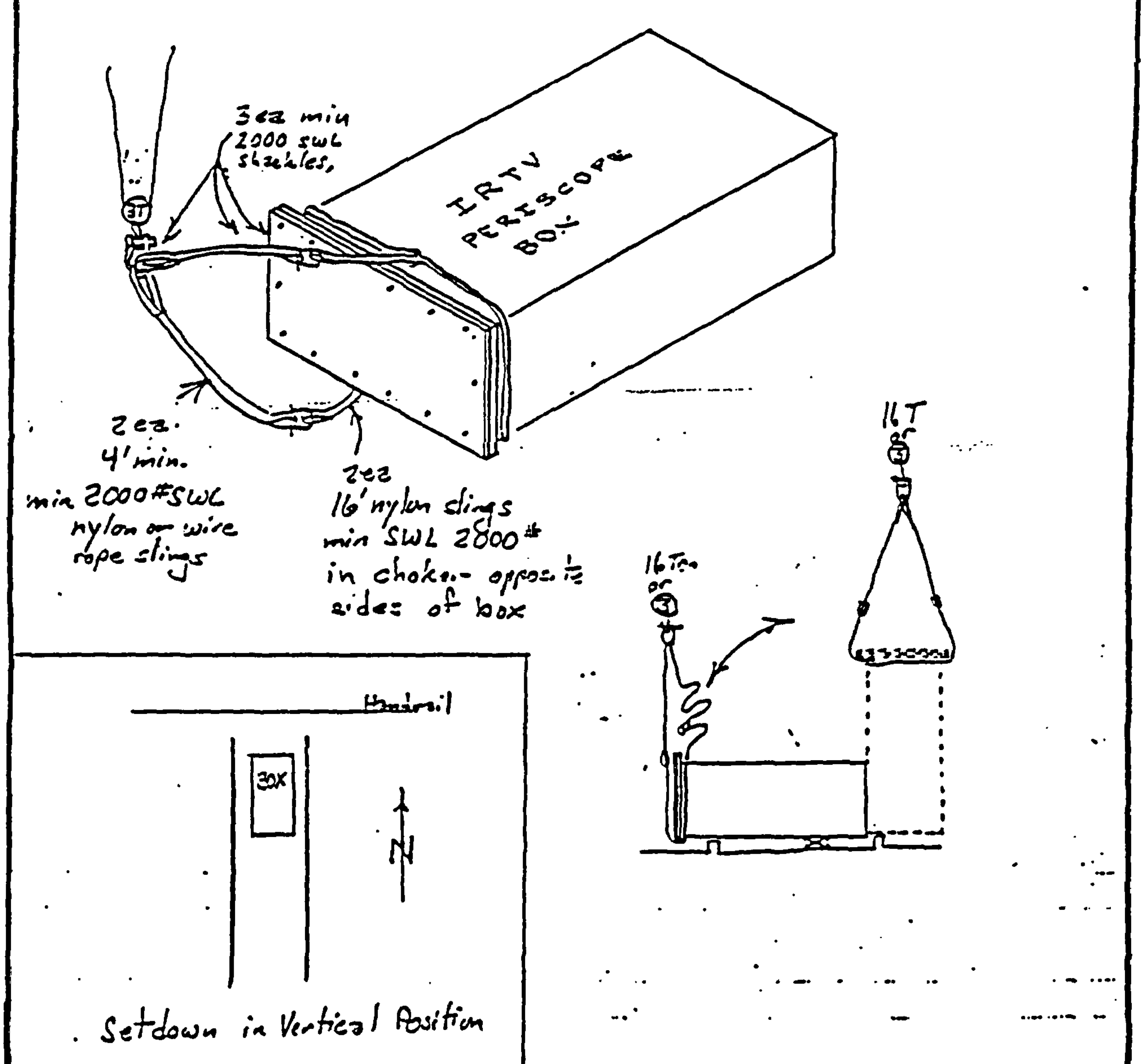
West Valley, New York



SUBJECT: IRTV Periscope Rigging	NUMBER: SKDJP110188-1	PAGE 1 OF 1	
	PREPARED BY: D1Plett	DATE: 11-01-88	
	CHECKED BY: [signature]	DATE: 11/14/88	

FIGURE 14

West Valley Nuclear Services Co. Inc.
West Valley, New York



SUBJECT: IRTV Box Pick Uprighting and Setting down	NUMBER: SKD.TP 11018A-2 PAGE 1 OF 1
	PREPARED BY: D.I.Plaet DATE: 1 Nov 88
	CHECKED BY: L Potts DATE: 11/11/88

FIGURE 15

Completed By

3. Connect the 1/2 inch swagelok connector to the periscope bottom lens cooling air fitting. See figure 16. Valve in the emergency air supply cylinder and preset the regulator to 18 psig. Establish flow of instrument air from IR 10 (using FCV-2040 at 100 percent open) through FI 2040 to the periscope. Close valve 2040A and verify PAL-2040 audio and visual alarm, also verify a minimum 2.5 SCFM flow from the emergency air regulator through the rotameter. Reopen valve 2040A and alarm should clear and flow increase to >3.3 SCFM.

4. Connect the PUREX 3-way connector to the air/steam supply 3-way nozzle, ensuring that the bottom (A) port is connected to the air line from loop 2041. __________

5. Valve in air and steam to the periscope at IR 1C, and air via loop 2041 from IR 10. Establish air flow on 2041 at 18 SCFM or greater on auto control. See figure 17. __________

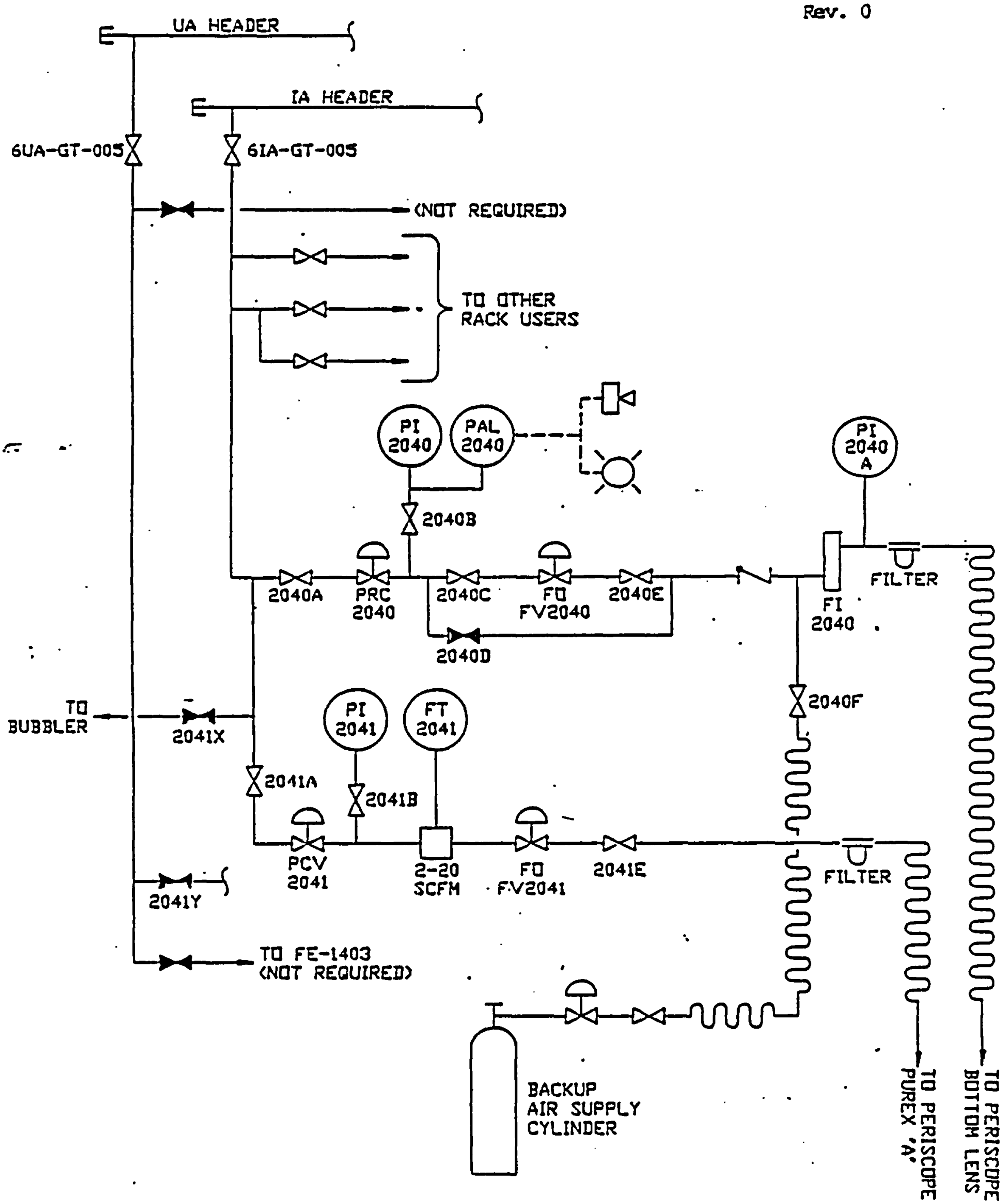
6. Install the periscope in nozzle V-20B with furnished gasket (or aluminum gasket if the original becomes unusable). Bolt in place with washers and 1 inch carbon steel bolts. __________

7. Set up IRTV electronics and turn on per shift supervisor instructions. See section 6.9.

8. Start the automatic steam purge of the lense aperture area using DCS HIN 2042, Micon 2, Loop 8. The picture should be strongly affected during the purge, and then return to normal. Lense will purge for 90 seconds every hour.

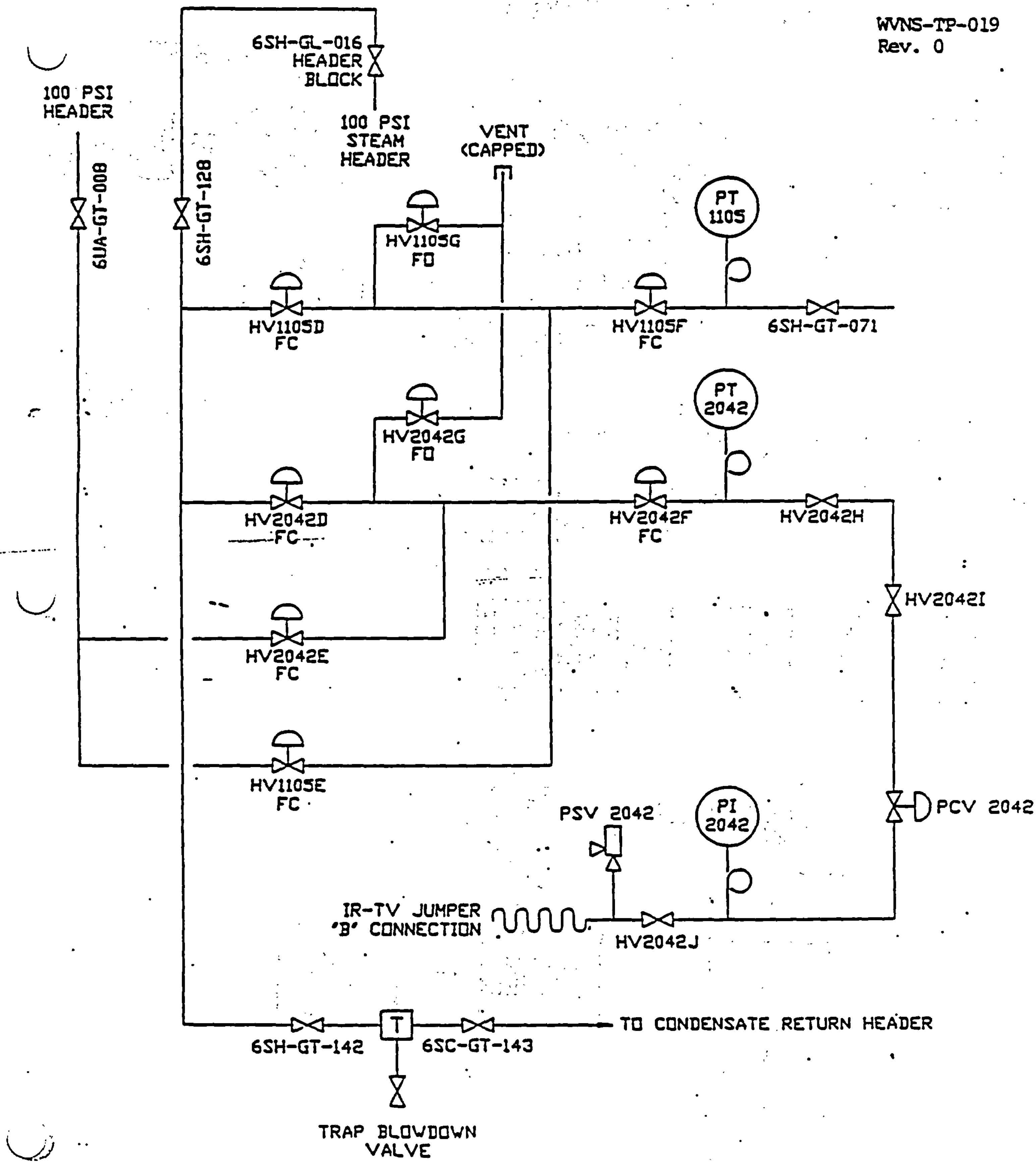
9. The logic flow for protection of the bottom periscope lens is shown on figure 18. For filter change purposes, the air flow may be shut down <u>only</u> if the plenum temperature is <u>less than 800°C</u>.

10. Readings are to be taken twice per shift unless the frequency is modified by the shift engineer. (see "Data Sheet for IRTV") figure 19.



AIR SUPPLIES FROM IR-10 TO IR-TV PERISCOPE.

FIGURE 16



STEAM SUPPLY FROM IR-1C TO IR-TV PERISCOPE

FIGURE 17

IRTV COOLING DECISION TREE

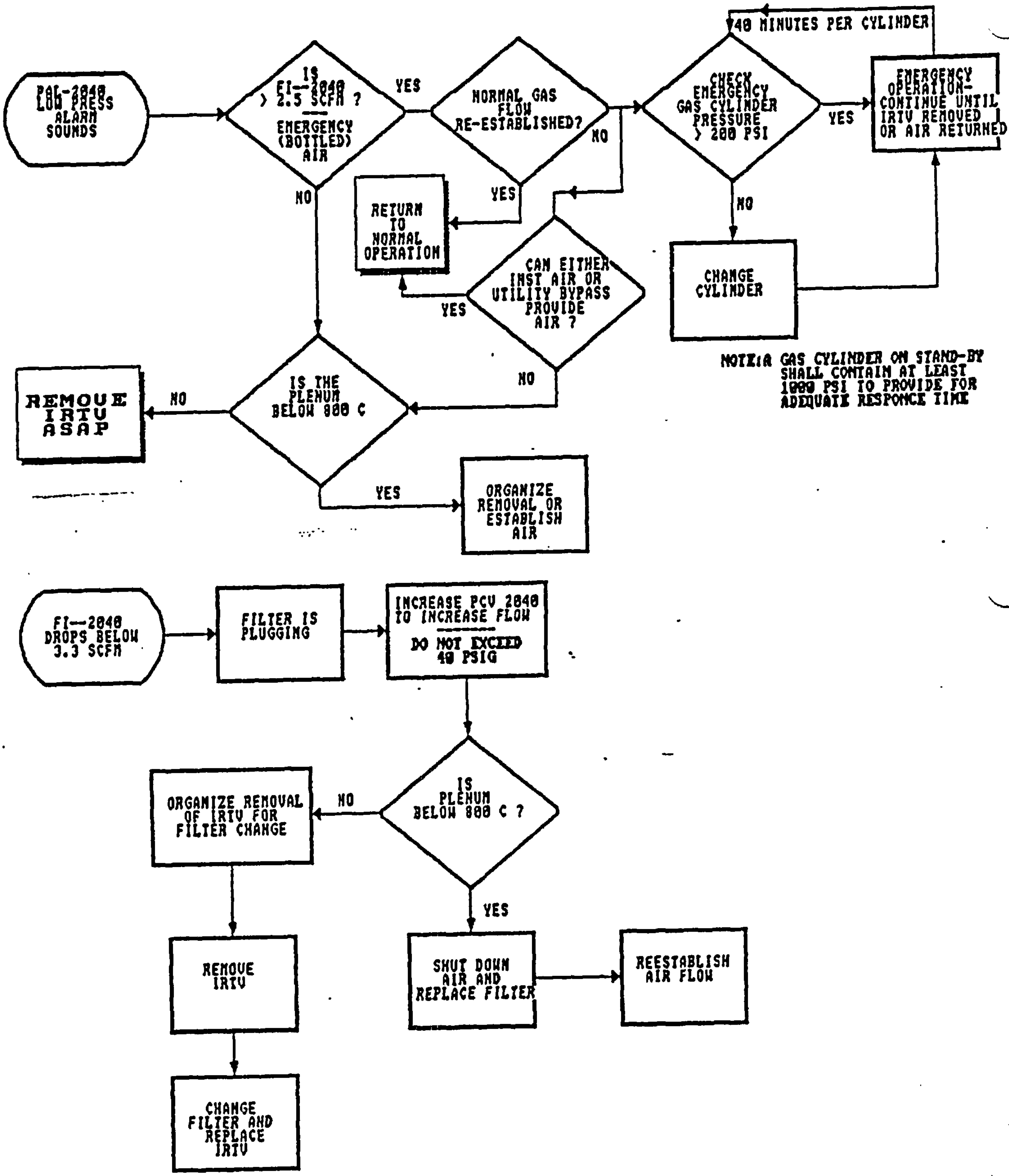


FIGURE 18

DATA SHEET FOR IRTV

TWICE/SHIFT

DATA SHEET FOR IRTV

TEST ENGINEER REVIEW: ____________________

DATE	TIME	PI 2040	PI 2041	PI 2040A	PI 2040	HIC 2041 SCFM	HIC 2041 M/A OUTPUT	TT 2040	OPERATOR/ /REMARKS

Figure 19

7.7 Final System Preparations - Start Feed System

The following check sheet should be verified prior to beginning feeding of the melter. Any deviations are only authorized by the Supervisor and Shift Engineer. Deviations will be noted on this check sheet.

7.7.1 All steps in Paragraph 7.1.1 through 7.6.11 of this document have been satisfactorily accomplished.

Verified Operator ____________

Noted Supervisor ____________

NOTES: ____

7.7.2 Verify that the following are ready (these can be checked any time during run preparations):

- emergency cabinets are stocked ____________
- sampling stations are set up ____________
- all applicable calibration stickers are in date ____________
- H_2O_2 on station at 01-14 ____________
- H_2O_2 has been charged to the scrubber columns. ____________
- analytical request sheets are on station ____________
- DCS and Data Historian are prepared for operation per SOP 63-5. Historian is in circular format. ____________
- all video equipment checked out ____________

Completed By

- process log is activated ________
- prerun samples taken per sampling plan, and log samples and tank levels (or volumes) per paragraph 8.12. ________
- EMOA alarm isolated. ________
- supervisor has DCS security key. ________
- activity diagram updated and initialed by Supervisor or Shift Engineer. ________
- all purged air sensing lines are blown down per paragraph 10.2 to include:

  V01 Level Probes ________
  V11 Level Probes ________
  V31 Level Probes ________
  V20 Level Probes ________

7.7.3 Process Development verify satisfactory glass boundary layer temperature profile to begin feeding. ________

7.7.4 Process Development verify MFHT, CFMT, and Melter level indicators are operating adequately for their purpose. ________

7.7.5 QA hold points are signed off on activity diagram per Paragraph 5.4. ________

7.7.6 Start feeding per Supervisor and Shift Engineer. See section 6.3.1 and ADS pump operation. ________

NOTE: Use ADS pump flush cycle to cool the melter feed nozzle prior to starting feed.

Completed By

7.8 Preparation for Boildown

7.8.1 Perform and/or verify the following prior to starting the boildown.

- Verify that the off-gas sampling personnel are prepared to begin sampling as needed per section 8.8, Sampling.

- Complete the "CFMT Boildown Instrument Checklist," table 7. __________

[+] - Close the valve between the MFHT and test condenser as necessary to establish a proper vacuum and provide an open flange or connector on the MFHT to allow venting. __________

[+] - Verify that the volume of the CFMT is <21,500 litres __________

[+] - Verify that hose is run from the condensate collection tank to the TCCMUT (garage tanks) __________

[+] - Remove PI-001 from the top of the test condenser and add approximately 200 litres of demineralized water to the test condenser through the tap, and replace PI-001 __________

[+] - Verify operation of the condensate collection tank pump by pumping any liquid in the tank to one of the TCCMU tanks __________

[+] - Fill the vessel vent system seal legs with demineralized water __________

[+] - Verify operation of the MFHT/CFMT emergency vent. Place transmitter alarm high on PT--1501 (Micon 1, Input 13) below the process variable; verify that the vent valve opens, then reset the high alarm. __________

TABLE 7

CFMT BOILDOWN INSTRUMENT CHECKLIST

1. Check the condition of the following HINs. Any that are found to be "on" should be put to "off:"

HIN NUMBER	INITIAL CONDITION	FINAL CONDITION	OPERATOR/DATE
HIN-101A			
HIN-103A			
HIN-101B			
HIN-103B			
HIN-101C			
HIN-103C			

2. Verify that the instruments in step 2 (with the exception of the PI-XXX) have been added to the DCS hourly process log for hourly operator review.

Completed By

[+] - Set up the valving per the following: no autovalves are to be operated at this time. (Verify that HIN-101A, HIN-101B, HIN-103A, and HIN-103B are all in the "off" condition). This configuration allows steam flow in the normal, downflow direction, and cooling water flow from the top of the jacket toward the bottom. ______

[+] - Verify that the off-gas diesel blower fuel tank is approximately 85 percent full. Fill if necessary. ______

[+] - Check that all connectors and flanges on the CFMT and the test condenser are bolted tight. ______

[+] - Verify that the jet line between the CFMT and the MFHT is closed or disconnected. ______

[+] - Lock and tag open the valve between the CFMT and condenser. ______

7.8.2 Verify the following items in the event that a re-start of concentration occurs during the run.

[+] - Close the valve between the MFHT and test condenser as necessary to establish a proper vacuum, and provide an open flange or connecter on the MFHT to allow venting. ______

[+] - Verify that all flanges and connectors on the CFMT are bolted down and that there are no openings from the tank to the atmosphere. ______

[+] - Verify that the data historian is recording, at least, in five (5) minute intervals. ______

[+] - Verify that the CFMT agitator is operating. ______

Completed By

[+] - Notify the PSO Supervisor of the intended usage of plant cooling water and valve cooling water flow through the test condenser shell. ____________

[+] - Check that the CFMT seal pot has at least twenty (20) but not more than twenty five (25) inches of water above the submerged hose end. ____________

[+] - If a vacuum is being maintained on the SVS Melter, do not close the valve between the SVS Melter and the HEME. If their is not a vacuum on the SVS Melter, close the valve between the SVS Melter and the HEME. ____________

7.8.3 Off-Gas System Startup

[+] - Verify that the off-gas system is operating per the RSVs. ____________

NOTE: Once vacuum is established, hourly readings shall be recorded. See section 8.1.10.

7.9 Initiate CFMT Boiling

The following steps address the use of the CFMT bottom and side jackets to heat, and eventually boil the contents of the vessel in order to evaporate water from the slurry.

NOTE: The steam flows may be stopped at any time by reducing FIC-101A and FIC-103A to zero output; by setting HIN-101A and HIN-103A to "off;" or by trip-out caused by high vessel pressure (PT-0114). When the steam is stopped, the jacket pressure is maintained by jacket pressurizers HY-101C and HY-103C, which adds air to the jacket at 4 psig, and stops adding air at 14 psig. The pressurizers should always be active so as to ensure that the jacket pressure never falls below the pressure exerted by the vessel contents on the inside of the jacket.

NOTE: Because of conductivity limits on the steam condensate returned to the boiler in UR, the non-steam liquid, i.e., CLCW, added to the steam condensate sump must be kept to a minimum. Therefore, the CFMT jacket that is to be used will always be cleared of liquid to the cooling water return system before steam is introduced into the jacket.

7.9.1 This step establishes CFMT vacuum to ensure ventilation during boildown, and also provides sufficient vacuum to clear the interlock for high vessel pressure on PT-0114.

- Throttle the off-gas valve at the HEME while setting PIC-1501 (Micon 2; Loop 1) to obtain a vacuum of approximately -5 inches water on the CFMT.

- Open slightly the valve between the MFHT and the condenser to provide approximately 100 SFM airflow at FT-1501 (a different flow rate may be used if directed by the VOS). This provides a baseline airflow to allow PIC-1501 to function, and simulates the conditions that will be present in the final system.

- Set PT-0114 transmitter alarm hi to -0.5 inches WC (Micon 9; Input 7).

- Set PT-1501 transmitter high to -0.5 inches WC (Micon 1; Input 13).

7.9.2 Collect off-gas particulate samples per section 8.9, Sampling.

7.9.3 This step empties the bottom CFMT jacket and establishes steam flow in and condensate flow from the jacket.

- Manually open GT-092 on the bottom jacket CW return line and allow the jacket pressurizer to empty the bottom jacket into the CLCW return header. Air will be heard escaping into the CLCW surge tank. If the jacket will not clear, the air pressure may be too low. To increase the jacket pressure, put HIN-103C to "on," this forces HY-0103C to open the jacket up to the setting of PRV-0103C. When the jacket is clear, first manually close GT-092, and then put HIN-0103C to "off."

- Put HIN-0103A to "on" to start steam on the bottom jacket. This allows the output of FIC-0103A to operate FV-0103A, and opens the condensate out valve HV-0104A. HV-0103C will cycle open and closed until the steam being added to the jacket develops sufficient pressure to keep the pressurizer satisfied. Gradually increase the manual output of FIC-0103A until a stable steam flow is seen. FIC-0103A may then be placed in automatic with a flow setting of 500 pounds/hour, or other rate specified by the VOSS of SE.

- Using PIC-1501, change the set point to 0 inches of water and then return to a setting of -5 inches to check the trip of FIC-103A. Trip forces FIC-103A to manual at zero output. Gradually increase the manual output and reestablish steam flow as in step 5.3.2.

7.9.4 This step empties the CFMT side jacket and establishes steam flow in and condensate flow from the jacket.

- Manually open GT-091 on the side jacket CW return line and allow the jacket pressurizer to empty the side jacket into the CLCW return header. Air will be heard escaping into the CLCW surge tank. If the jacket will not clear, put HIN-101C to "on" (as in 5.1.1 for the bottom jacket). When the jacket is clear, first manually close GT-091, and then put HIN-101C to "off."

- Put HIN-101A to "on" to start steam on the bottom jacket. This allows the output of FIC-0101A to operate FV-0101A, and opens the condensate out valve HV-0102A. HV-0102A and the pressurizer autovalve HV-0101C will cycle open and closed until the steam being added to the jacket develops sufficient pressure to keep the pressurizer satisfied. Gradually increase the manual output of FIC-101A until a stable steam flow is seen. FIC-101A may then be placed in automatic with a flow setting of 1500 pounds/hour, or other rate specified by the shift engineer or VOSS.

- Using PIC-1501, decrease the set point to 0 inches of water and then return to a setting of -5 inches to check the trip on FIC-101A. The trip will force both FIC-101A and FIC-103A output to manual at zero output. Gradually increase the manual outputs of FIC-101A and FIC-103A to reestablish steam flows as in steps 5.3.2 and 5.4.2.

7.10 Boiling Operation when the CFMT Reaches the Boiling Point

7.10.1 If at any time, any of the NO_x limits are exceeded as described in section 6.5.2, shut down the steam to both jackets of the CFMT and notify the VOSS.

7.10.2 Condensate Handling

- When the condensate tank is full, (approximately 50 inches on LIC-300, Micon 2; Loop 5) start pumping by changing the output of LIC-300 from 0 to 100 percent. When LIC-300 reaches 1 inch, return the output setting to 0 percent.

- Sample the condensate collection tank during transfers to a TCCMU tank as directed by the VOSS.

  - o samples shall be 60 mL
  - o samples shall be labeled with the following:

    - "CFMT Boildown"
    - time
    - date
    - CFMT level
    - system flow rate

7.10.3 When approximately 800 gallons of condensate is collected in one of the TCCMU tanks, perform the following:

- Record the volume of the TCCMU tank in the CTS Log Book and obtain a 60 mL sample per the direction of the VOSS.

- Label as above with the addition of the wording "transfer solution."

- Transfer the boildown contents from the garage tank to the tank specified by the VOSS per SOP 63-7.

- Record the level of the tank transferred to the CTS Log Book.

7.10.4 When the target level is reached, or when the boildown must be interrupted, put HIN-101A and HIN-103A to "off." Then perform the steps in section 7.9 to secure from boildown.

8.0 TEST INSTRUCTIONS

8.1 Data Requirements

The following data are to be taken during the run. The frequencies stated apply to operating periods only and can be modified by the Shift Engineer. Changes shall be noted in the operations log. See appendix D for a summary of process control strategy.

NOTE: Each completed data sheet should be reviewed and signed by a shift engineer. The review should take place during the run if possible. Signature does not signify a detailed process review.

8.1.1 The 01-14 NO_x monitor shall be positioned (valves arranged) to measure total NO_x and NO at the post scrubber position at least once a day. The monitor shall be moved from the post scrubber position only long enough to take readings from the other positions and then returned to post scrubber. See section 6.5.2 for other NO_x monitor requirements.

8.1.2 Glass air lift data will be taken on the Canister Filling Balance, figure 20 for each air lift. For additional instructions on the load cell readings see section 8.2.1.

8.1.3 Slurry feed rate data will be taken on figure 21 once per shift, and at feed rate changes.

8.1.4 Data will be taken on the Canister Filling Balance Data Sheet, figure 20, or on a RS/1 generated "data sheet," if available. Use figure 22, Glass Production Factor, graph, and the slurry specific gravity to obtain the factor for calculation 2 on figure 20.

8.1.5 Record bubbler data twice per shift on Bubbler data sheet, figure 23, when the bubbler is in use.

8.1.6 Catalytic pilot plant data will be taken once per shift, see section 8.4.

8.1.7 Check the film cooler every hour and record data on film cooler data sheet, figure 24.

8.1.8 Building 01-14 off-gas data shall be recorded twice a shift while the electric blower is operating on off-gas data sheet, figure 25. If the diesel driven blower is operated, take data on the Diesel Blower Data Sheet, figure 26.

8.1.9 The CFMT and MFHT Slurry level will be taken before the start of the run and before and after each slurry transfer. Record these results on the Transfer Data Sheet, figure 27.

8.1.10 Boildown data shall be taken every hour during any period of concentrating in the CFMT. Record data on figure 28 CFMT Hourly Reading Sheet.

CANISTER FILLING BALANCE DATA SHEET

CANISTER NUMBER: ________ PAGE NUMBER: ________

Load Cell Tare Weight ____________

Test Engineer Review ____________

AIR LIFT #	DATE	START LT-2009 TIME	FINISH LT-2009 TIME	LT-2009 CHANGE 1	FEED ADDED 2	GLASS VOLUME TRANSF'D 3	TOTAL VOLUME	WEIGHT GLASS 4	TOTAL WEIGHT	WI-4101 START	WI-4101 FINISH	TOTAL LOAD CELL TEMPERATURE ST	FIN
				FT^3	FT^3	FT^3	pounds	pounds	pounds	pounds		°C	°C

CALCULATIONS - See attached for derivation.

1 LT-2009 Change = (LT-2009 Start - LT-2009 Finish)
2 Feed Added = ($Time_2$ - $Time_1$) x (feed rate) x (Glass Production Factor from figure 22)
3 Glass Volume Transferred = 0.82 x (LT-2009 Change) + Feed Added
4 Weight Glass = 150 x (Glass Volume Transferred)
5 WI-4104 Change = (WI-4101 Finish - WI-4101 Start)

NOTE:

2450 lbs approximately 50% full
3920 lbs approximately 80% full
4165 lbs approximately 85% full

MFHT Specific Gravity ________ as of ________
________ as of ________
________ as of ________

FIGURE 20

CALCULATIONS FOR FIGURE 20

1. Level change from air lift [in H_2O]:

   LT-2009 at start - LT-2009 at finish

2. Glass Addition Due to Feed Addition [ft^3]:

   Feed added = feed rate [litres/hour] x Time duration [hours] x

   $$0.50^{*} \frac{\text{kg glass}}{\text{litre feed}} \times 2.2 \text{ [lb/kg]} \times \frac{1}{150} \frac{ft^3}{lb}$$

   = feed rate x ($Time_2$ - $Time_1$) Glass Production Factor*

3. Glass Volume Transferred [ft^3]:

   $$= \frac{\text{Level Change [in } H_2O]}{2.4 \dfrac{\text{in } H_2O}{\text{in glass}} \times 12 \text{ [in/ft]}} \times 2.2 \text{ [}m^2\text{] melter surface} \times 10.76 \frac{ft^2}{m^2}$$

   + feed added = 0.82 x level change LT-2009 + feed added.

4. Glass Weight Transferred [lb]:

   $$= \text{glass volume transferred [}ft^3\text{]} \times 2.4 \text{ specific gravity} \times 62.4 \frac{lb}{ft^3}$$

   = glass volume transferred x 150

---

* oxide loading can change due to concentration or dilution, use figure 22, with the vessel specific gravity

MFHT
SLURRY FEED RATE DATA

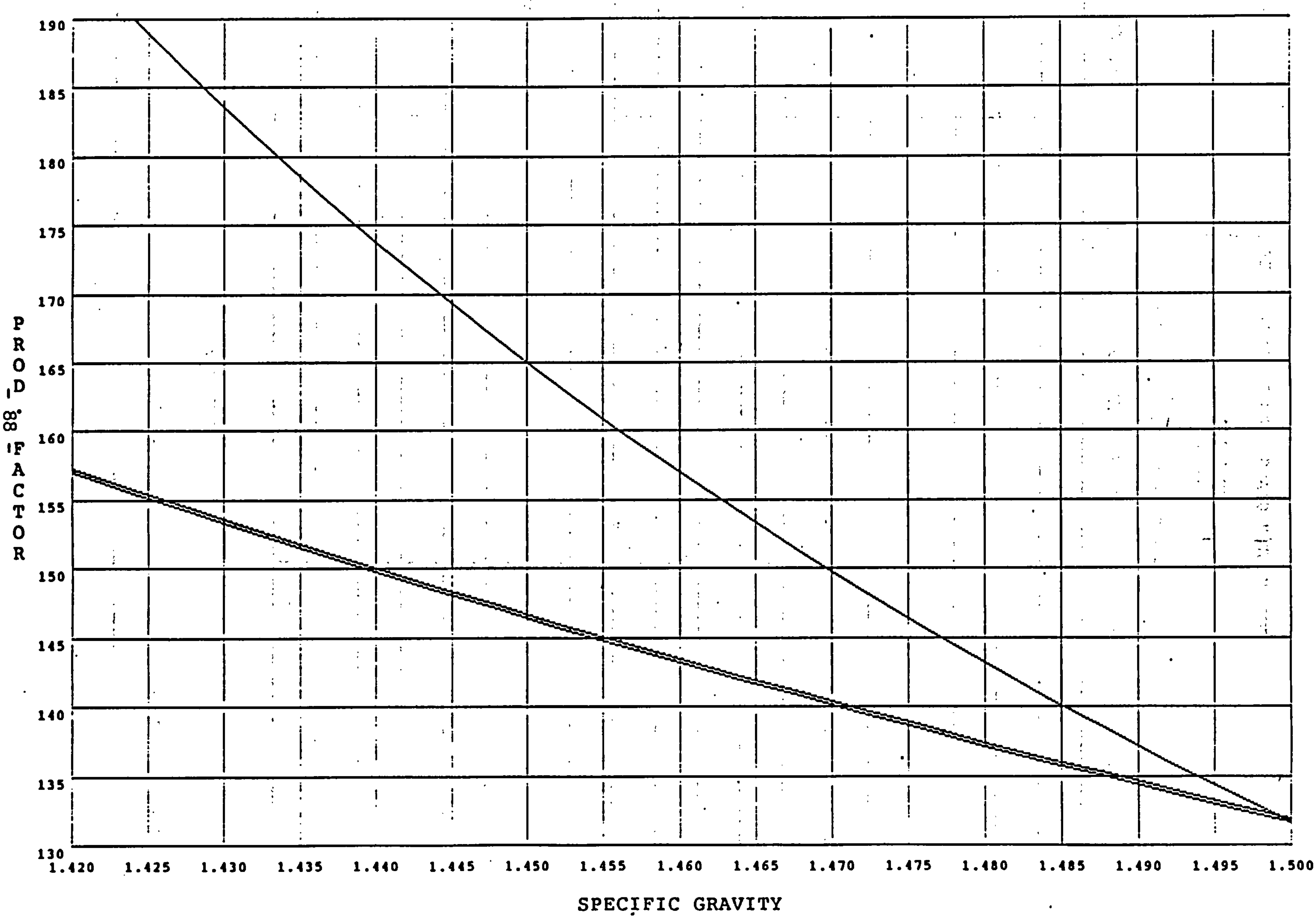
Eng Review ______________

DATE/TM	DIP TUBE LT-1101	DIP TUBE LT-1103	DIP TUBE LT-1105	COSA LT-1104	DENSITY PROBE DIX-1101	DENSITY PROBE DIX-1103	COSA LEVEL CHANGE	DIP TUBE AVERAGE	CORRECTED DIP TUBE AVERAGE	DIPT. LEVEL CHANGE CALC.	1 VOL CHANGE CALC.	INCRE-MNTL FEED RATE	24 HOUR FEED RATE

FIGURE 21

1. Volume change = level change x 177 litres/inch
2. Level data to be taken with the agitator off.

FIGURE 22
GLASS PRODUCTION FACTOR



MELTER GLASS BUBBLER DATA SHEET

TEST ENG ____________________

TAKE DATA EVERY FOUR HOURS

DATE	TIME	BUBBLER AIR FLOW	INITIALS	COMMENTS

FIGURE 23

FIGURE 24

FILM COOLER DATA

TEST ENG.: ______________
Page ___ of ___

DATE/TIME	INITIALS	PIX-2020 MICON 6, BT 7	RODDED YES/NO	COMMENTS

TEST ENG. ___________
Page ___ of ___

OFF-GAS DATA SHEET
(ELECTRIC BLOWER)

DATE/ TIME	INIT	BLOWER INLET FILTER DP (Max 30)	BLOWER OUTLET FILTER DP (Max 30)	BLOWER COOLING OUTPUT TDIC-8801	BLOWER INLET TEMP ^oF	BLOWER OUTLET TEMP ^oF	BLOWER OIL PRESS (9-13)	BLOWER OIL LEVEL OK/Fill	DIESEL IN AUTO YES/NO	DIESEL FUEL LEVEL OK/Fill	NO_x SAMPLE POSITION	NO_x CONC. PPM	NO CONC. PPM

Figure 25

DIESEL BLOWER DATA SHEET
Typical Reading Listed

Date	Time	Init	Inlet Temp °F	Outlet Temp °F	Engine Press	Engine Water	RPM	Blr OK Press	Blr OK Level	Elec Auto?	Fuel %	Comments
			65°F Delta T Max		25-35	160-180	1150-1200	10-12	M			

Figure 26

CFMT SLURRY TRANSFER

DATE/TIME: ____________________ TEST ENG ____________________

BATCH NO.: ____________________

Bubbler MFHT level pre xfer

LT-1101	LT-1102	LT-1103	LT-1104	LT-1105

Bubbler CFMT level pre xfer

LT-0101	LT-0102	LT-0103	LT-0104	LT-0105

Bubbler MFHT level post xfer

LT-1101	LT-1102	LT-1103	LT-1104	LT-1105

Bubbler CFMT level post xfer

LT-0101	LT-0102	LT-0103	LT-0104	LT-0105

Comments:

FIGURE 27

CFMT HOURLY READING SHEET
(BOILDOWN)

Date ---	Time ---	PI-0101 IR-05	PI-0101C IR-05	PI-0103A IR-04	PI-0103C IR-04	LIC-300 Litre/hr RATE CHEC	PI-001 COND.TOP	TI-001 COND.TOP	FT-001 COND. CW	FIC-1501	Operator INITIALS

Figure 28

8.2 Turntable

8.2.1 Turntable Load Cell

The load cell, mounted on the west side of the turntable, will monitor the weight of a canister properly positioned at the west fill position. Because of the configuration of the canister/lobe supports, the load cell will only see part of the weight, or weight increase, at that position.

The load cell transducer is mounted locally to the melter glass sample area. The transducer is connected to the DCS under tag ID number WT-4101, Micon 3, Input 8, to allow automatic recording of load cell readings. A thermocouple is positioned at the load cell pin inside the T/T to establish whether or not load cell response is temperature dependent. The thermocouple is under tag ID number TT--4109.

Record the tare weight on figure 21 when an empty canister is placed under the pour spout for glass filling. As part of the air lift data sheet, figure 21, load cell weight and thermocouple readings shall be recorded before and after every airlift. Report any inconsistencies in the Vitrification Log Book as well as any reasoning for the inconsistency.

When visually checking canisters, note load cell reading before unloading from load cell. When replacing canister on load cell, load cell reading should be close to the same as that before the canister was unloaded. If it is not, make a note in the daily log and comment on any process anomalies which could have caused this.

Last canister used in run shall be left on the load cell while cooling to monitor load cell and temperature response. This shall be a minimum of two days, longer if possible.

8.2.2 Turntable LVDT

LVDT output will be found on the DCS on ZT--4101 if available. The reading will correspond to turntable position.

LVDT Reading (ZT-4101)	LVDT Reading (local)	Lobe under Pour Spout	Lobe under LVDT
0.14	7	A	C
0.16	8	B	D
0.23	10	C	A
0.28	13	D	B

8.3 Vessel Vent Simulation

The purpose of this evolution is to simulate the anticipated flow contributed by the permanent system load on the off-gas system.

During SF-12 the CFMT will be operated, that is feed will be concentrated. During concentration the simulation described below will be discontinued.

The permanent vessel vent system consists of the off-gas condenser and interconnecting piping to all of the vessels in the CTS, except for the melter. Later, the emergency vent for the melter will be connected to the vessel vent system.

The vessel vent system, at present, consists of only the condenser, MFHT, CFMT, and the six inch pipe connecting them. A mass flow meter has been added to the system just before it attaches to the off-gas system. The meter correlates heat dissipation in the meter to gas mass velocity, and the result is displayed as SCFM for a particular pipe size. The vessel vent pipe at this location is 3 inch sch 40 pipe. The pressure control valve will be adjusted by FIC-1501 to get a desired flow rate at the flow meter once the melter pressure system has been set up.

To facilitate the vessel vent simulation, Micon 2 has been configured with both a pressure control loop PIC-1801 and a flow control loop, FIC-1501 and a discrete HIN-1501 to switch between the two control modes. PIC-1501, Loop 1 is the master loop and is the control when HIN-1501 is off and displays "PSIA". Control is transferred to Loop 8, FIC-1501, when HIN-1501 is ON displays "SFCM". Automatic control is terminated on either loop when a switch is made between the loops.

The off-gas blower can operate at a vacuum of up to 130 in w.c. A maximum set point limit of 120 in w.c. will be observed for this test.

Prior to the start of melter feed:

1. The melter pressure system will be adjusted as follows: PIC-2004 at -5 in w.c., film cooler, FIC-2020, at 140 SCFM, and blower vacuum adjusted to give at least 70 SCFM on FT-2004.

2. Prop open a flange cover or other suitable opening to allow in-leakage into the MFHT, and CFMT and verify that both off-gas isolation valves are open.

3. Set the pressure/flow control switch, HIN-1501 to "ON" (bonus tag will indicate "SCFM") so that FIC-1501 will be activated. Both controllers are on Micon 2. PIC-1501 is Loop 1 and FIC-1501 is Loop 8.

4. Adjust flow to run sheet value.

8.4 Catalytic Pilot Plant

8.4.I Introduction

The purposes of the pilot plant test is to demonstrate Norton's NC300 series catalyst and gather data to support the full scale catalyst reactor design. The pilot plant is located on the CTS viewing platform. Test runs shall operate with an inlet reactor temperature of around 320^{o}C and a gas flow rate of approximately 20 SCFM corresponding to a space velocity of 2540 air changes per hour. A 0.9 to 1.0 molar ratio of ammonia to nitrogen oxides should be used for a majority of each test period. Some operating periods may be at nonstandard conditions for testing purposes.

A constant base flow rate through the reactor for the duration of the test periods will provide the most useful data with respect to catalyst life and reactor design of the full scale unit. The reduction of nitrogen oxides in the West Valley Nuclear Service's melter off-gas can be measured and analyzed for the changes in reactivity over the accumulated pilot plant operating time. This data can be extrapolated to determine the catalyst life for a nitrogen oxides reduction efficiency of greater than or equal to 91 percent.

Three modes of operation may be used in testing the catalytic pilot plant. The first mode is a low maintenance or life testing mode. Data will be taken, to keep track of the operation of the equipment. The second mode is manual efficiency testing, and the third mode is the implementation of an automatic control strategy for the catalytic reactor. Each of these modes are described below.

The NO_x concentration is measured at both the inlet and outlet of the pilot plant.

8.4.2 Pilot Plant Automatic Features (All Modes)

A. ammonia valve will shut off on low reactor temperatures and blower not operating

B. reactor outlet high temperature - alarm only

C. heater outlet low temperature - alarm only

D. heater over temperature shut down

8.4.3 Operation - Life Testing Mode

A "life testing mode" of operation can be run at other times with little operator attention to continue to expose the catalyst to melter off-gas conditions. The "life testing mode" of operation is to determine any detrimental process effects on the life of the catalyst (i.e., poisoning of the catalyst bed by chemical compounds in the melter off-gas and increased pressure drop across the catalyst bed due to fouling or thermal degradation of the catalyst.) With little operator attention the pilot plant is run ammonia deficient or with ammonia shut-off to prevent the possibility of ammonia breakthrough. Ammonia slip at the reactor outlet shall be checked by established wet chemistry methods. Frequency of checking shell vary from up to 4 times a day to once in 3 days, depending upon the mode of operation.

8.4.4 Operation - Efficiency Mode

This manual mode of operation requires a lot of operator attention. At present, the system will be manned by WVNS Engineers. Emphasis should be placed on maintaining a constant gas flow rate of approximately 20 SCFM through the reactor. The gas flow rate is influenced greatly by the inlet gas temperature and pressure over the range of expected gas temperatures and pressures of the melter off-gas. The following operating conditions should be checked as often as required to maintain the desired test conditions:

- Pilot plant gas flow temperature and pressure after the blower

- The reactor inlet nitrogen oxides concentration

- The ammonia flow corresponding to the gas flow and inlet nitrogen oxides concentration

- The reactor inlet gas temperature

Most importantly, an adequate ammonia supply shall be maintained for the duration of each test. Also, the pilot plant heater over temperature protection system shall be checked periodically to see that an over temperature condition has not shut down the heater.

Normal operation mainly consists of achieving and maintaining desired test conditions and providing an adequate ammonia supply for each test period. To achieve the desired gas and ammonia flow conditions in the pilot plant, the calculation equations presented are utilized with temperature and pressure data and the inlet reactor nitrogen oxides concentration from the nitrogen oxides analyzer.

1. To determine the required vortex flow meter reading for the desired SCFM of gas flow through the pilot plant, the equation is

$$Mhw = \frac{Qs\ (Tg + 273)}{15.22\ (B \pm 0.0361 \times Pg)}$$

Where Mhw = % of calibrated vortex flow range
Qs = gas flow rate, SCFM at 14.7 psia and 60°F
Tg = gas temperature at the outlet of the VORTEX flow sensor °C
Pg = static positive or negative pressure (denoted by $\pm$ in equation) of gas flow at the outlet of the VORTEX flow sensor, inches of water
B = barometric pressure, psia.

NOTE: B = 14.0 psia

2. To determine the required ammonia flow rate for use in the rotameter setting calculation, the equation is

$$NH_3 = 28.92 \times 10^{-6}\ (Qs)\ (NO_x\ PPM)\ (Ratio)$$

Where NH_3 = ammonia gas flow, SLPM at 14.7 psia and 70°F

Qs = gas flow, SCFM at 14.7 psia and 60°F

NO_x PPM = nitrogen oxides concentration at the reactor inlet, ppm (moles of nitrogen oxides per 10^6 moles of gas)

Ratio = moles of ammonia fed to moles of nitrogen oxides present, dimensionless

3. The ammonia flow rotameter setting corresponding to the

desired ammonia flow is given by the following equation.

$$\text{Indicated flow} = 0.0087 \times (NH3) \times \left(\frac{Ta}{Pa}\right)^{1.5}$$

Indicated flow = flow from Matheson Model 604 rotameter calibration curve (figure 29).

Ta = ammonia gas temperature, ^oK

NOTE: Use ambient air temperature.

Pa = ammonia gas pressure, psia

NH_3 = desired ammonia gas flow, SLPM at 14.7 psia and 70^oF.

8.4.5 Operations - Automatic Mode

The efficiency of the SCR technology is dependent upon the stoichiometric ratios of NH_3 and NO_x at the catalytic reactor. With $NH_3:NO_x$ ratios >1 NO_x removal efficiencies up to 97 percent have been observed. However, under these conditions there is unreacted NH_3 present in the reactor effluent stream. Since plant compliance with NO_x emission limits only require 91 percent removal, NH_3 effluent concentrations can be minimized (at the expense of efficiency) by running the SCR process lean eg) $NH_3:NO_x \leq 1$. Control of the catalytic pilot plant is maintained by adjusting the ammonia addition. The ammonia may be controlled based on the inlet NO_x concentration and the flow rate. The $NH_3:NO_x$ ratio is input by the operator to adjust the unit efficiency. The micon microprocessor-based multiloop controller coupled with a mass flow control valve for ammonia injection, is used to maintain process control.

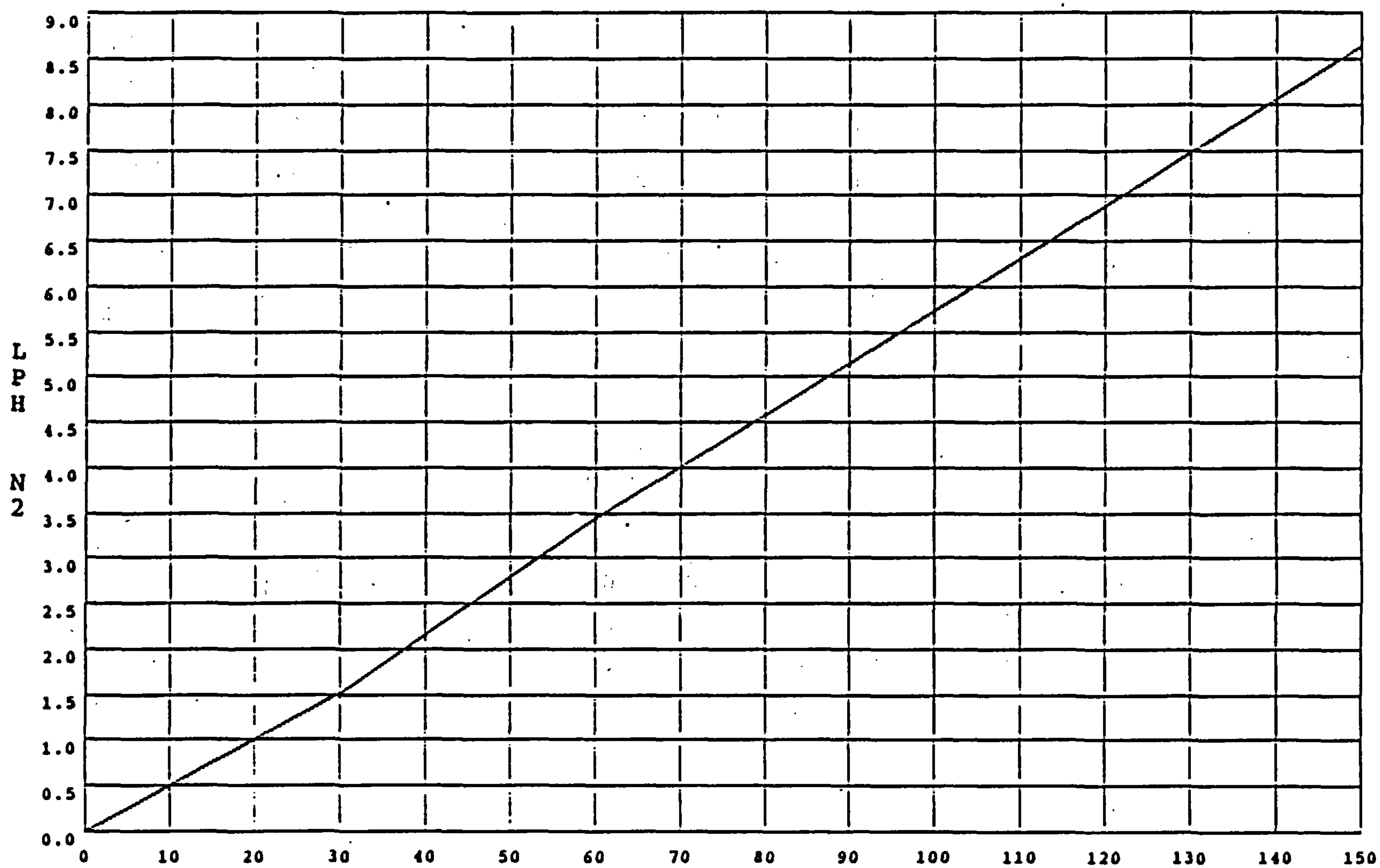
8.4.6 Vendor Assistance (Norton)

Personnel from Norton Company may also be on hand to assist with operation of the Pilot System for the Selective Catalytic Reduction (SCR) of melter generated NO_x per the performance requirements given above. (Norton is the supplier of the Pilot SCR unit.)

8.4.7 PNL Assistance

Personnel from other WVNS groups and the Pacific Northwest Laboratory of Battelle Corporation (PNL) may also be on hand to assist with operation of the Pilot System for the Selective Catalytic Reduction of melter generated NO_x per performance requirements given above.

AMMONIA FLOW CURVE (BASED ON CAL REPORT #318853)



ROTAMETER TUBE DIVISIONS
TUBE #604

CALBRATION GAS: N2 @ 21.9C AND 752 mmHg

Figure 29

8.4.8 Ammonia

The ammonia cylinder should be replaced when a low-level of ammonia is indicated on the weight scale. The following steps to change out ammonia cylinders are:

NOTE: Gas cylinders are to be handled only with safety cap in place.

1. Turn off the ammonia flow switch at the reactor control panel to close the ammonia flow solenoid valve.
2. Close the pressure regulating valves at the ammonia cylinder and close the ammonia cylinder head. Replace the empty cylinder with a full one.
3. Open the new ammonia cylinder head and then open the pressure regulating valves to the original ammonia supply pressure.
4. With the pilot plant running, turn on the ammonia flow switch at the reactor panel to open the solenoid valve and restart ammonia flow.

8.4.9 Pilot Plant Data Sheet

The following data sheet, figure 30, is provided for taking pilot plant data.

8.5 Melter Probing

In order to follow melter details during the run, it may become necessary to sample the cold cap or glass, or to measure the temperature of the melter/glass components. Any probing will be done under the direction of the Shift Engineer. Normal glass sampling occurs after all NO_x has been burned off the melt, the procedure outlined below will allow probing the melter during a run with NO_x present. Normal process ventilation will control the evolving gases.

NOTE: Notify particulate sampling and NO_x treatment testing personnel prior to feed interruption, if testing is in progress.

1. A separate IWP will be necessary for sampling. A NO_x monitor will be set up on the melter lid to detect any escaping NO_x, and the sampler will wear a SCBA apparatus for the sampling effort if the feed has been off for less than 1/2 hour. An observer will be nearby with a mask and acid vapor canister.

WVNS SCR Pilot Plant Data

Run No. ____________________

Date:
Time:

Gas Conditions					
Temperature, °C (TI-1)					
Pressure, in of H_2O (PG-1)					
Flow Meter Reading, % (Ch. 20)					
NOx Conditions					
Inlet Reactor NOx ppm (Molar Basis) (Ch. 12)					
Outlet Reactor NOx, ppm (Molar Basis) (Ch. 13)					
NH3 Flow Data					
NH_3/NOx Ratio (P. Gain)					
NH_3 Temp, F (Room Temperature)					
NH_3 Pressure, psig (PG-4)					
NH_3 Flow SLPM (Ch. 15)					
Rotameter Setting, mm (FI-2)					
Reactor Conditions					
Heater Outlet Temp, °C					
Reactor Inlet Temp, °C (TI-2)					
Catalyst Bed Temp, °C (TI-3)					
Catalyst Bed Temp, °C (TI-4)					
Catalyst Bed Temp, °C (TI-5)					
Catalyst Bed Temp, °C (TI-6)					
Catalyst Bed Temp, °C (TI-7)					
Reactor Outlet Temp, °C (TI-8)					
Catalyst Bed Pressure Drop, in of H_2O					
Reactor Pressure Drop, in of H_2O					
Run Time Meter Reading, Total Hours					

Initials: ____________________

2. Melter feed will be shut off during actual sampling, and liquid will be allowed to boil off before the melter is opened. This should take approximately 10 minutes.

3. Air to the Film Cooler, FIC-2020, shall be lowered to less than 20 SCFM. Adjust the high alarm set points for PT-2004 and PIC-2004 to -0.1 in w.c. (atmospheric pressure).

4. Shut off vessel vent air.

5. Control room operator to monitor melter vacuum/blower operation. Maintain radio communication with the melter front personnel.

6. Sampler may need an insulating board or blanket available to close off the selected sample nozzle in the event of a ventilation problem (Fiberfrax or equivalent).

7. Melter power shall be shut off during the actual sampling per Vitrification Standing Instruction.

8. Melter probing shall be done with a sample "rake" or thermowell from the surface or pool as directed by the shift engineer. Follow normal sampling and numbering procedures. See Section 8.9.

9. If melter ventilation fails, the sampling effort will be terminated, and any open port closed off by its normal plug or the above insulation cover. The emergency vent will open at -0.1 in w.c., in the instance of total blower failure. Regain normal ventilation before continuing with sampling.

10. After the sample is taken, return vessel vent and film cooler air to run sheet settings, and resume feeding per the shift engineer's instructions (watch glass temperature).

8.6 SBS Surfactant

To alter the surface tension of the bed solution and hence limit liquid carry over from the SBS, a surfactant may be added to the bed solution. Surfactant use will be adjusted by a combination of surfactant additions/bed flushes as directed by the shift engineer, in conjunction with particulate sampling.

The surfactant is Dow Corning Antifoam 1410, a silicon emulsion, which easily dilutes in water. The surfactant will dilute with the addition of water condensed from the melter feed. Assuming all of the water condenses, and that the SBS is well mixed, 63 percent of the surfactant will dilute out in approximately 1 bed volume, or 3400 litres of water, or about 4500 litres of feed (55 hours of feed at 80 L/hr).

The following schedule will be observed through the run to maintain the surfactant concentration in the SBS bed:

NOTE: Use demineralized water for dilution

1) 1 litre of surfactant, diluted to 1 gallon minimum, may be added to the SBS bed before the run.

2) 0.5 litre of surfactant, diluted to 1 gallon, may be added every second day.

Surfactant can be added through the 6 inch flange "Y" on the SBS when it is down, or through the level probe at Rack 1A, (using process vacuum to suck the solution into the bed - chase the surfactant with an equal volume of water).

8.7 Slurry Sample System

8.7.1 General System Information

The Slurry Sample System (SSS) is an integral part of the feed preparation system. Its purpose is to take a sample of the slurry which can be sent to the lab for analysis and determination of the proper chemicals. In operation the waste from 8D-2, SBS, Canister Decon, and other waste streams are added to the Concentrator Feed Make-up Tank (V-001) and continuously mixed. A sample is taken to determine the feed concentration and feed makeup requirements. The feed is then adjusted and another sample taken to verify the madeup feed composition before transferring to the Melter Feed Hold Tank (V-011). Before transferring to the melter, another sample is taken from the MFHT, to verify the composition is unchanged. If necessary chemical adjustments can be made in the MFHT and a final sample taken to verify the results.

NOTE: Supplemental diagrams and sampler information can be found in appendix E.

8.7.2 Physical Characteristics

The Slurry Sample System is comprised of several components, listed below. An overall picture of the system can be seen in figure 31.

- Sample Station - Drawing PNL-402-01
- ADS Sample Pumps 63-G-002 and 63-G-012 - Drawing 900D-2466
- ADS Sample Pump Actuator PNL-407-01

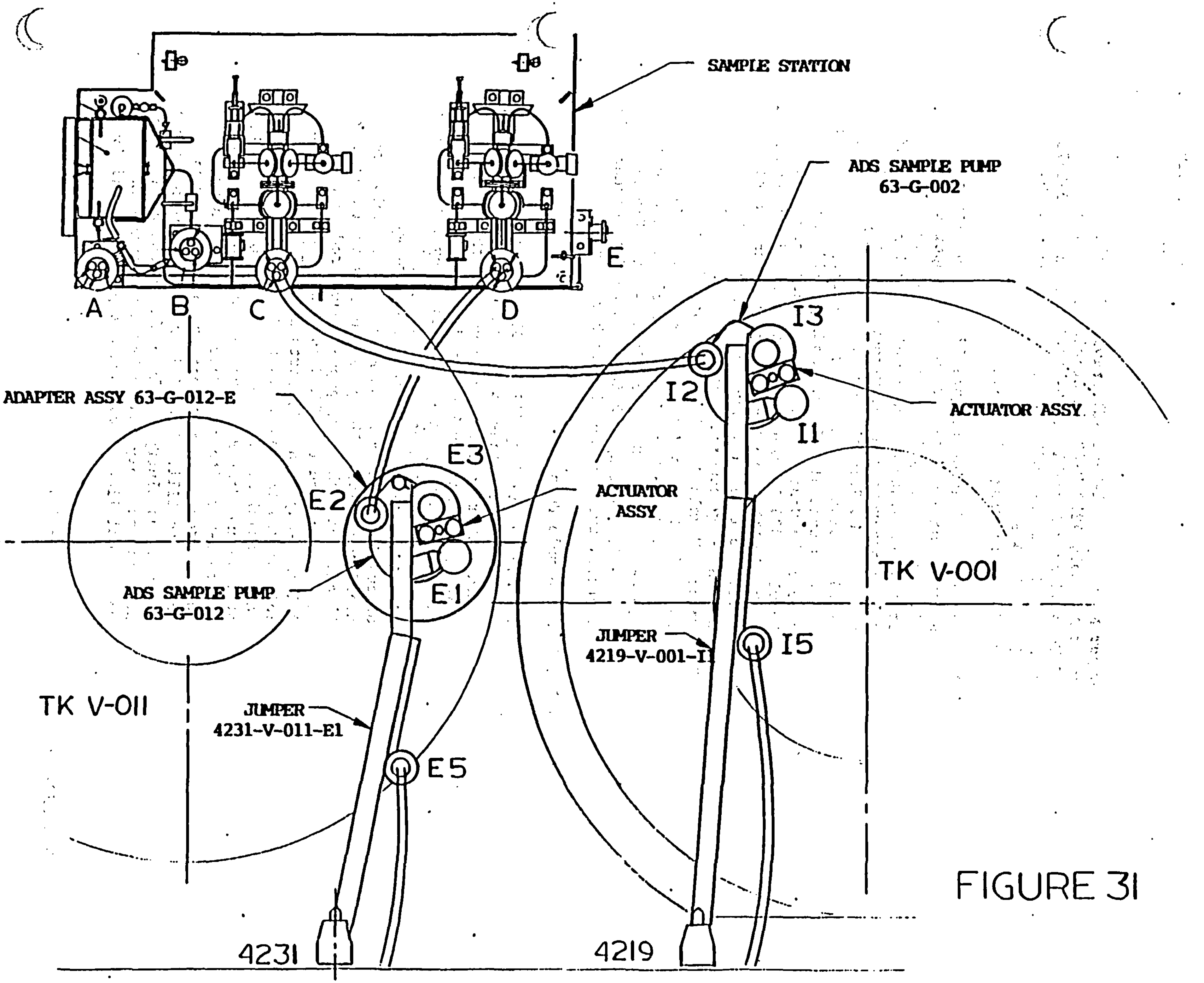

SAMPLE STATION
ADS SAMPLE PUMP
63-G-002
A
B
C
D
E
I3
I2
I1
ACTUATOR ASSY
ADAPTER ASSY 63-G-012-E
E3
E2
ACTUATOR
ASSY
ADS SAMPLE PUMP
63-G-012
E1
TK V-001
TK V-011
JUMPER
4219-V-001-I1
I5
JUMPER
4231-V-011-E1
E5
4231
4219

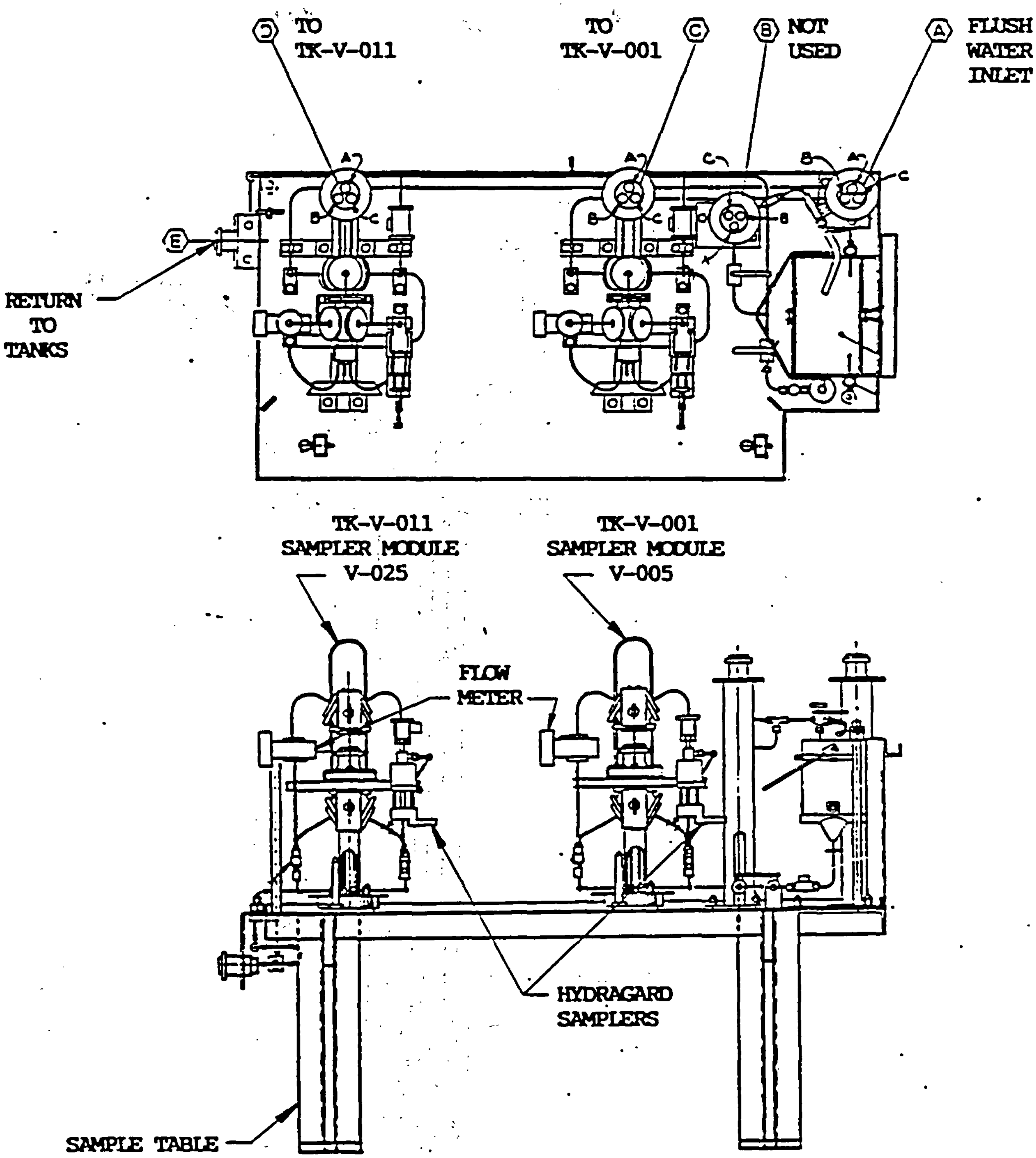
FIGURE 31

- Jumper Assembly 4231-V-011-E1 Drawing PNL-542-01
- Jumper Assembly 4219-V-001-I1 Drawing PNL-540-01
- ADS Pump Adapter Assembly 63-G-012-E Drawing 900D-2478
- ADS Sample Pumps 63-G-002 and 63-G-012 Remote Gasket Drawing 900D-2479
- Remote Gasket Drawing PNL-087-01

8.7.2.1 The Sample Station (figure 32) is approximately 6 feet long and 3 feet deep with supports on one side for mounting it on the wall module. The station consists of two sampler modules, 5 PUREX male connectors and inter-connecting pipe and valves. The Sampler modules, numbered V-005 and V-025 consist of a hydragard sampler, a flow meter and flow control valves. Module V-005 is used to sample the Concentrator Feed Makeup Tank (V-001). Module V-025 is used to sample the Melter Feed Hold Tank (V-011). The PUREX nozzles on the sample table are labeled A through E. Nozzle A is a 2 inch 3-way connector and is the inlet for flush water. Nozzle B will not be used during this run. Nozzle C, a 2 inch 3-way, is used to connect module V-005 to Tank V-001. Nozzle D is used to connect module V-025 with Tank V-011. Finally, nozzle E, a straight 2 inch, is used to connect the overflow from the modules to both tanks.

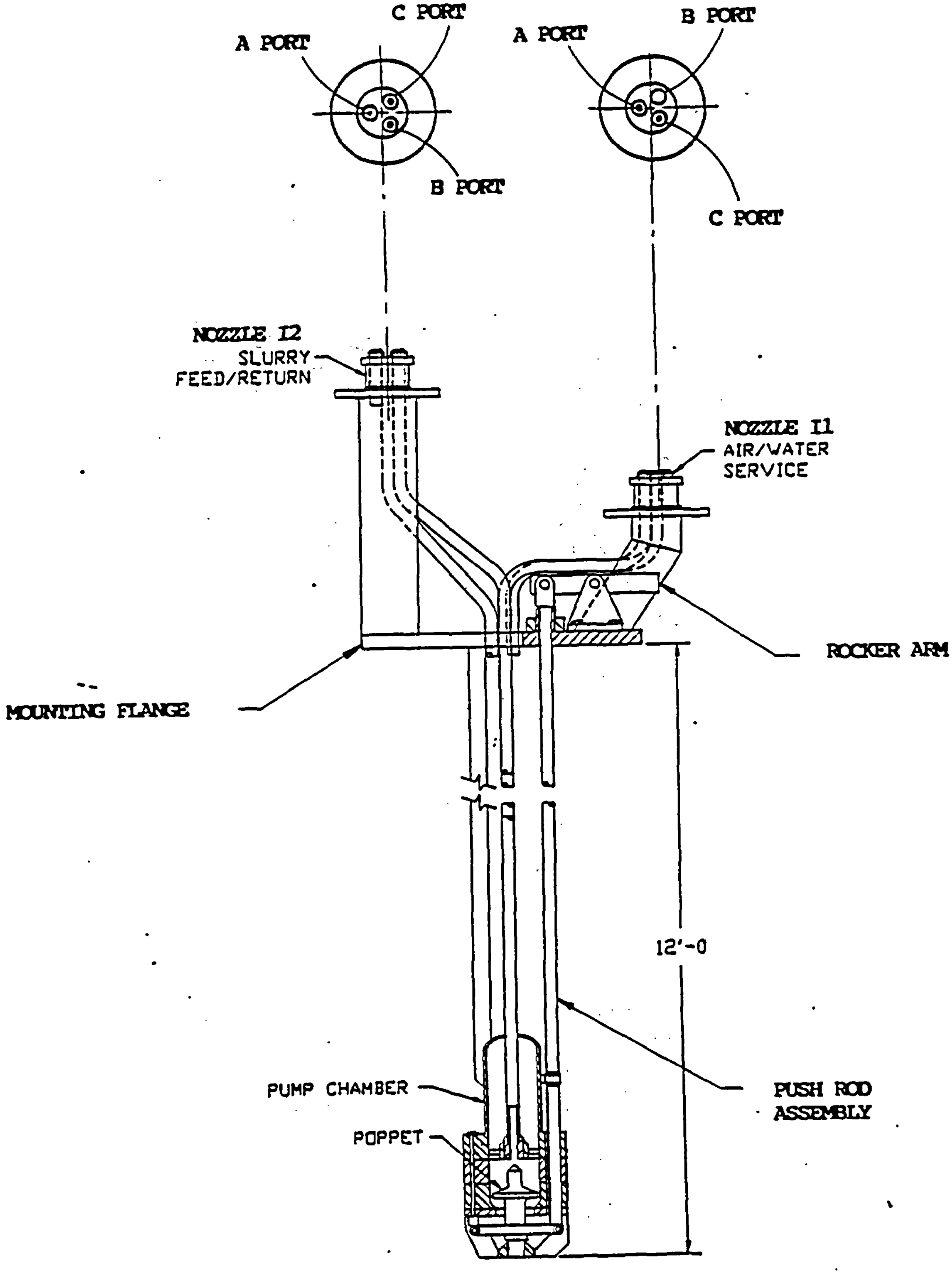
8.7.2.2 ADS Sample Pump

The ADS Sample Pump (figure 33) is used to transfer slurry from the tank to the sample station and back again. There are two pumps used in the sample system, one in Tank V-001 and one in Tank V-011. Although the pumps are identical they retain their own unique equipment number and nozzle identification. For this reason, further discussion will be about Pump 63-G-002 only, to avoid confusion. The pump consists of a mounting flange, pump chamber, poppet, push rod assembly, rocker arm, and two PUREX nozzles. Nozzle I2 is a 2 inch 3-way with only ports B and C being used. This nozzle is used to connect the pump with the sample station. Port C provides feed to the sample station and Port B is the return. Nozzle I1 is a 2 inch 3-way with only Ports A and C being used. Port A provides a vent path to allow the pump chamber to fill. Port C is for air or water supply to pump the slurry or flush the poppet area. The push rod assembly and rocker arm provide the mechanical linkage to move the poppet up and down



TO
TK-V-011
TO
TK-V-001
NOT
USED
FLUSH
WATER
INLET
RETURN
TO
TANKS
TK-V-011
SAMPLER MODULE
V-025
TK-V-001
SAMPLER MODULE
V-005
FLOW
METER
HYDRAGARD
SAMPLERS
SAMPLE TABLE

FIGURE 32



ADS SAMPLE PUMP

FIGURE 33

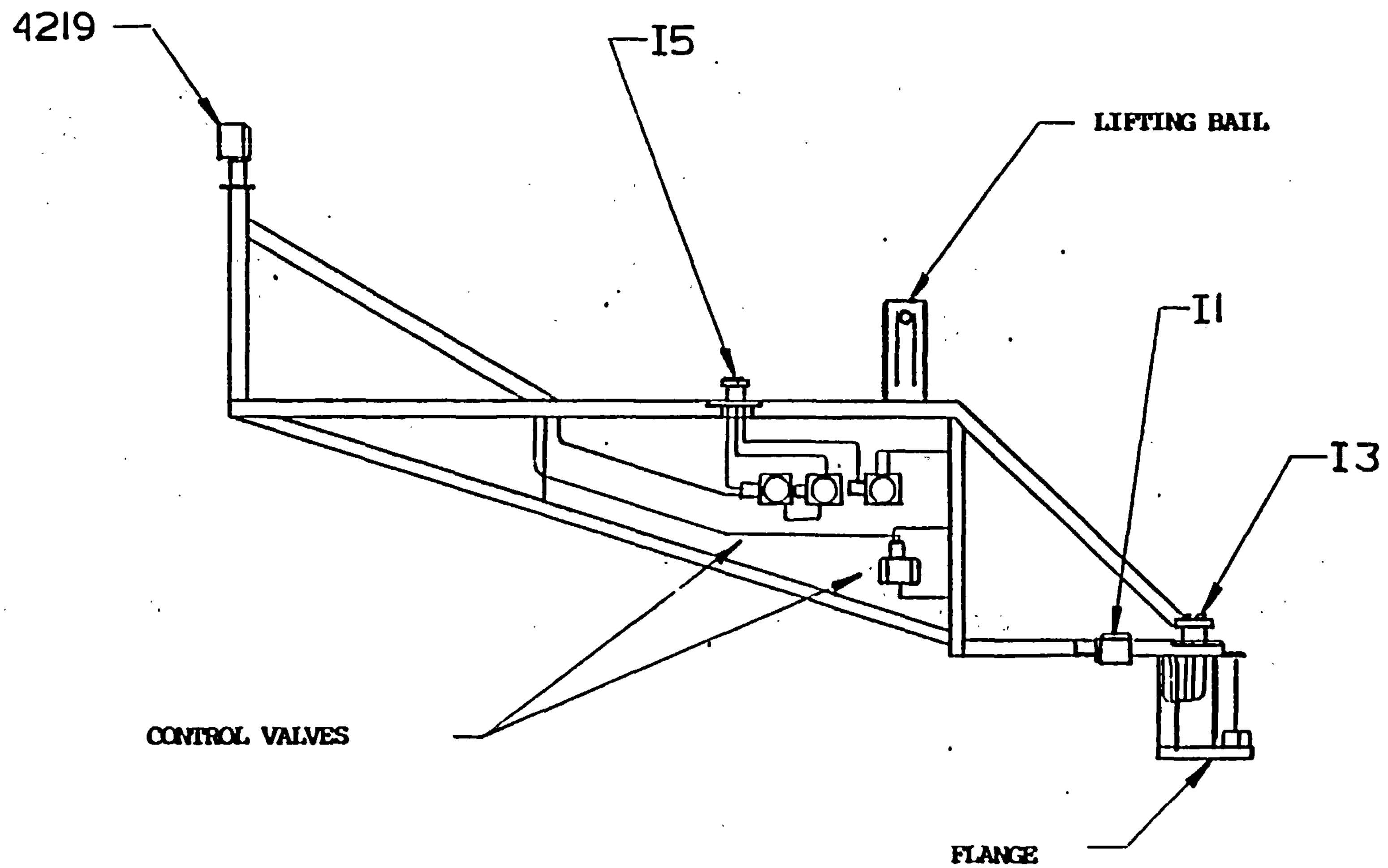
within the pump chamber. These two positions allow the chamber to fill or the slurry to be pumped out. These movements are provided by the actuator assembly and will be described in greater detail in the following section under "Actuator Assembly."

8.7.2.3 Jumper Assembly 4219-V-001-I1 and 4231-V-011-E1

These jumper assemblies are identical in their function and construction and differ only in their physical geometry. For this reason all further discussion will refer to Jumper 4219-V-001-I1. The purpose of this jumper is to provide air and water service to the sample pump (see figure 34). This jumper is constructed of SST Channel frame which supports various PUREX connectors and nozzles. The mid-section holds 4 air actuated control valves. The lower end has a flange to mate with the ADS sample pump, and there is a lifting bail located at the center of gravity. This jumper consists of 5 different connections, starting with connector 4219, a 2 inch 3-way which mates with a wall nozzles of the same type. Port A of the connector provides instrument air, Port B provides air and water, and Port C provides instrument air. Part way down the jumper is a 2 inch 3-way nozzle I5. This nozzle receives instrument air from another mating jumper to actuate the control valves. Connector I1, a 2 inch 3-way mates with nozzle I1 on the ADS sample pump which provides the air and water supply. The mounting flange on this jumper mates with the flange on the ADS sample pump and is secured with a remote nut. The last nozzle I3 is a special 3 inch 4-way, which provides air to the actuator assembly, which operates the pump push rod assembly.

8.7.2.4 Actuator Assembly

The Actuator Assembly (figure 35) is an integral part of the ADS Pump and Jumper Assembly 4219-V-001-I1. This assembly provides the mechanical force to move the pump rocker arm up and down by receiving air from the jumper. This assembly consists of a special 3 inch 4-way PUREX connector, two 3 inch Bimba cylinders, a 1 inch Clippard air cylinder and associated linkage connecting to dual cams. At assembly the jumper 4219-V-001-I1 is placed on top of the pump and secured. This jumper has the special 3 inch 4-way



JUMPER 4219-V-001-I1

FIGURE 34

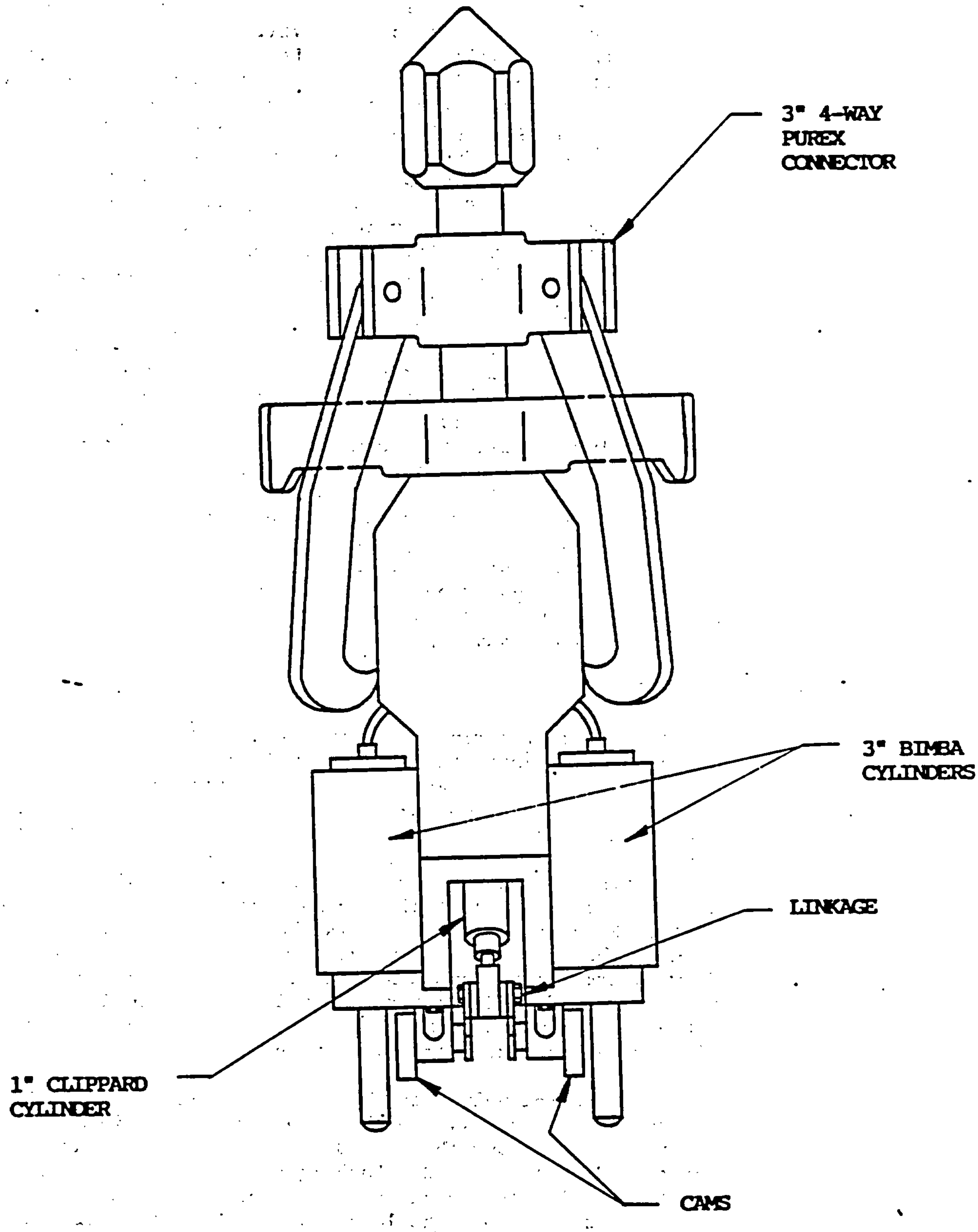


FIGURE 35
ADS SAMPLE PUMP ACTUATOR ASSY.

nozzle I3 which is used to couple the actuator assembly. This actuator will sit on nozzle I3 and the air cylinders will align with the rocker arm on the pump. Figures 36A, B, and C show the various functions of the actuator assembly and how it moves the pump poppet for various functions. In sketch 37A the actuator assembly is shown on the left and the pump chamber with the poppet is shown on the right. When air is supplied to cylinder A, it pushes on the rocker arm lifting the push rod assembly thus lifting the poppet and sealing off the feed line. This position then allows the slurry to enter and fill the pump chamber. Looking at figure 36B, air is supplied to cylinder D via the jumper. The rocker arm and push rod assembly are pushed down thus moving the poppet down. This seals off the pump chamber from the vessel contents. Air supplied to the chamber via the jumper will then push the slurry out of the chamber and up through the sample station and back to the vessel. In the third sketch, 36C, the middle cylinder C is pressurized thus moving the two cams downward. This positions the rocker arm in a horizontal plane thus moving the poppet to its center position. Water can now be added from the jumper and the sample station to flush out the chamber and poppet area.

8.7.3 Operation

The following paragraphs explain the operation of the SSS. The equipment configuration and services are not as they would be during hot operations, thus requiring radio communications between the operator and the control room. The operator at the SSS will be responsible for monitoring the flow, taking samples, timing the flush sequence and positioning the valves for the proper operational modes. In figure 37 the sample station is seen as if standing in front of it. Noted on this drawing is the equipment that will be used by the operator. There are two sample modules with flow control valves and a hydragard sampler. Between the modules is a flow indicator that will be used during sample extraction. On the right hand side is a PUREX connector with two valves, used for flush water supply.

The flow control valves in the sample module are shown in figure 38. These valves will be adjusted to various positions throughout the procedure. The positions are identified by A, B, or C. Looking at the upper valve it is set in position AB, by aligning the two wide handles with the letters A and B. The lower valve is set in position BC.

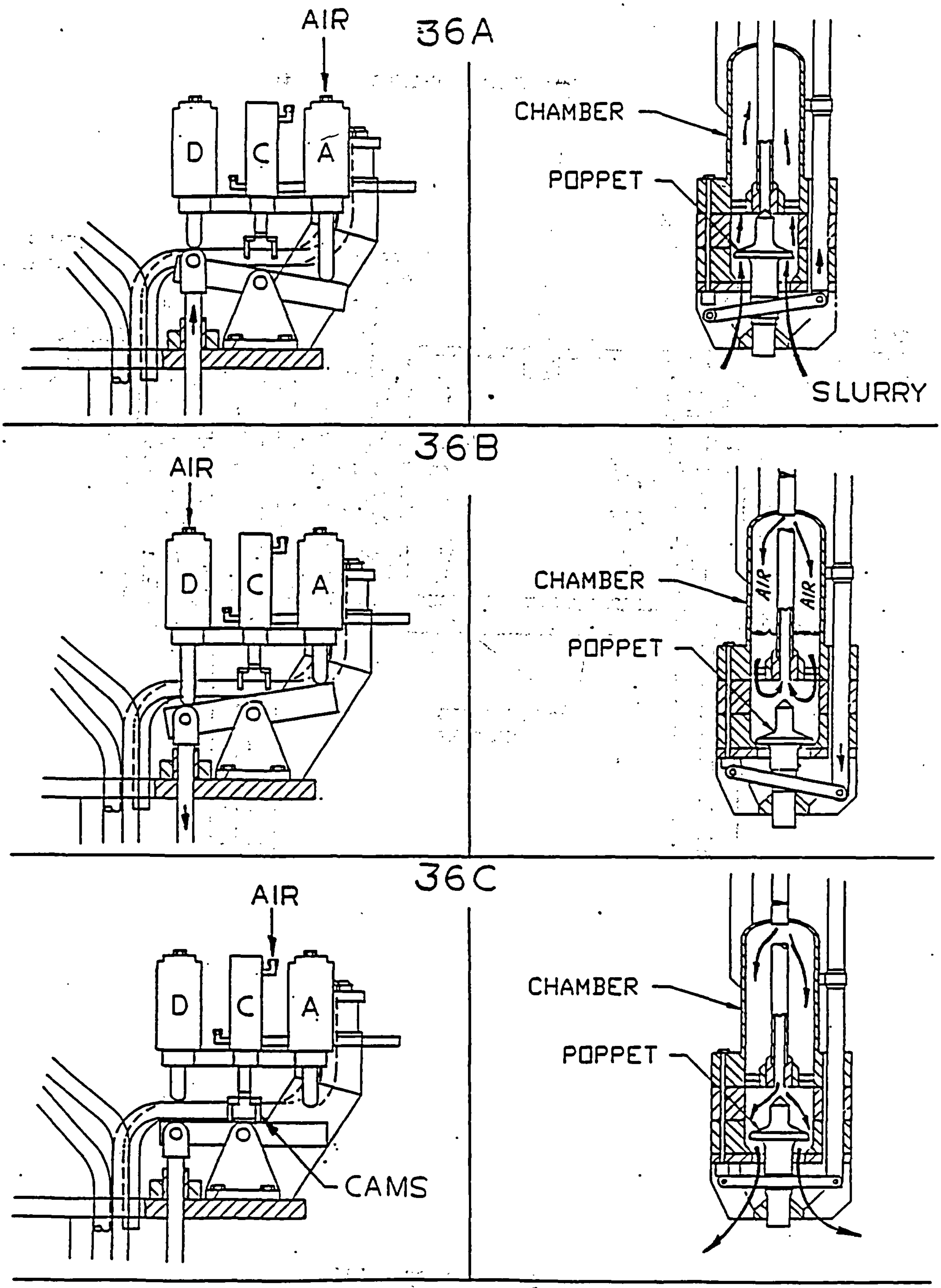


FIGURE 36A,B,C

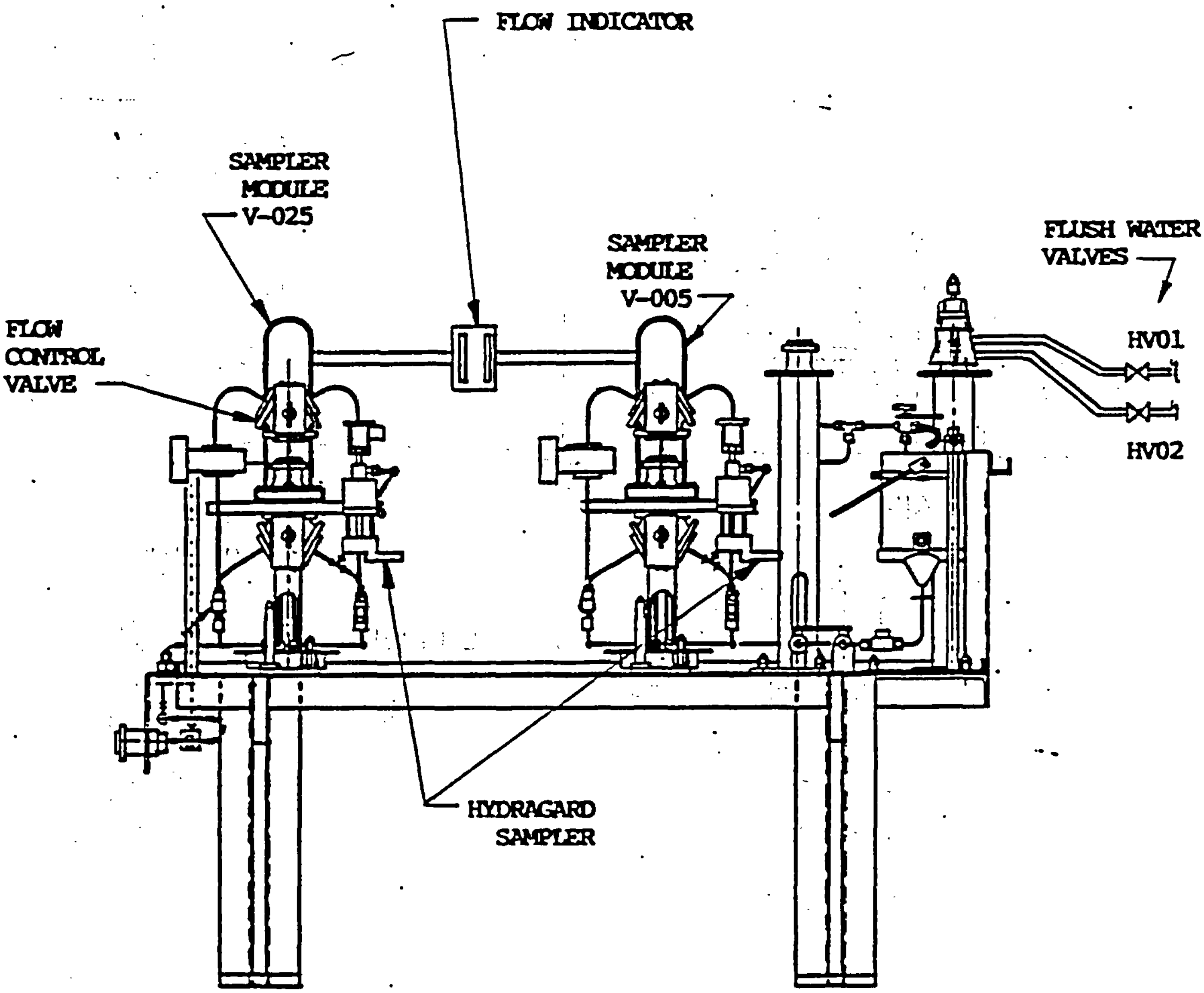

FLOW INDICATOR
SAMPLER MODULE V-025
SAMPLER MODULE V-005
FLUSH WATER VALVES
HV01
HV02
FLOW CONTROL VALVE
HYDRAGARD SAMPLER

FIGURE 37

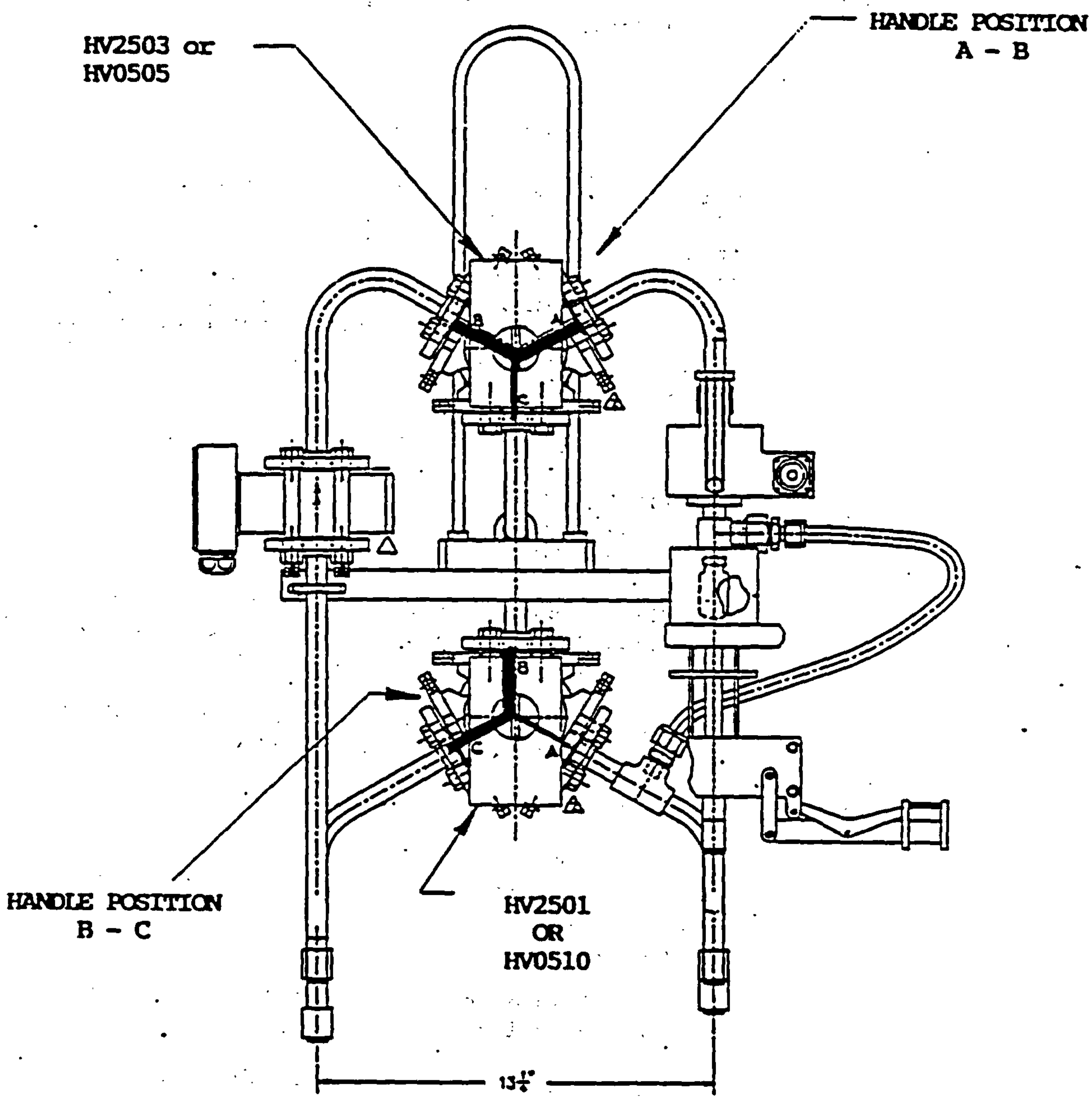

HV2503 or
HV0505
HANDLE POSITION
A - B
HANDLE POSITION
B - C
HV2501
OR
HV0510

FIGURE 38

Since the sample station has two sampler modules (one for each tank) that operate in the same manner, this procedure will refer to module V-005 only. The steps can be repeated for the other module.

8.7.3.1 Pump Mode

This mode only involves the pump running and circulating the slurry through the sample station and back to the tank. Experience has shown that after a pump has set idle for several hours, that it takes time for it to return to its full flow capacity. Therefore when restarting the pump, say after boil down or feed transfer the pump should be allowed to run for approximately one hour before taking samples. To set up for pump mode follow steps 3.1.1 through 3.1.2 and refer to figure 39.

- Set valves on the sample table as shown below:

HV0505 - AB	HV01 - Off
HV0509 - Open	HV02 - Off
HV0510 - BC	

NOTE: Locate valves HV0501 and HV0508 and verify they are closed. These two valves will not be included in this test run.

- The sample module is now in the pump mode and the ADS pump can now be turned on.

8.7.3.2 Sample Mode

After the ADS pump has been running for at least one hour, a sample can be taken by following steps 3.2.1 through 3.2.4 and referring to figure 40.

- The valves on the sample station will remain in their existing position.

- The ADS pump shall remain in the pump mode.

- Prepare the hydragard sampler per the manufacturers operating instructions attached. Paragraphs 3.1.3 and 3.2.2 of these instructions do not apply.

- The system is now ready to take a sample. Grasp the handle of the hydragard and watch the flow

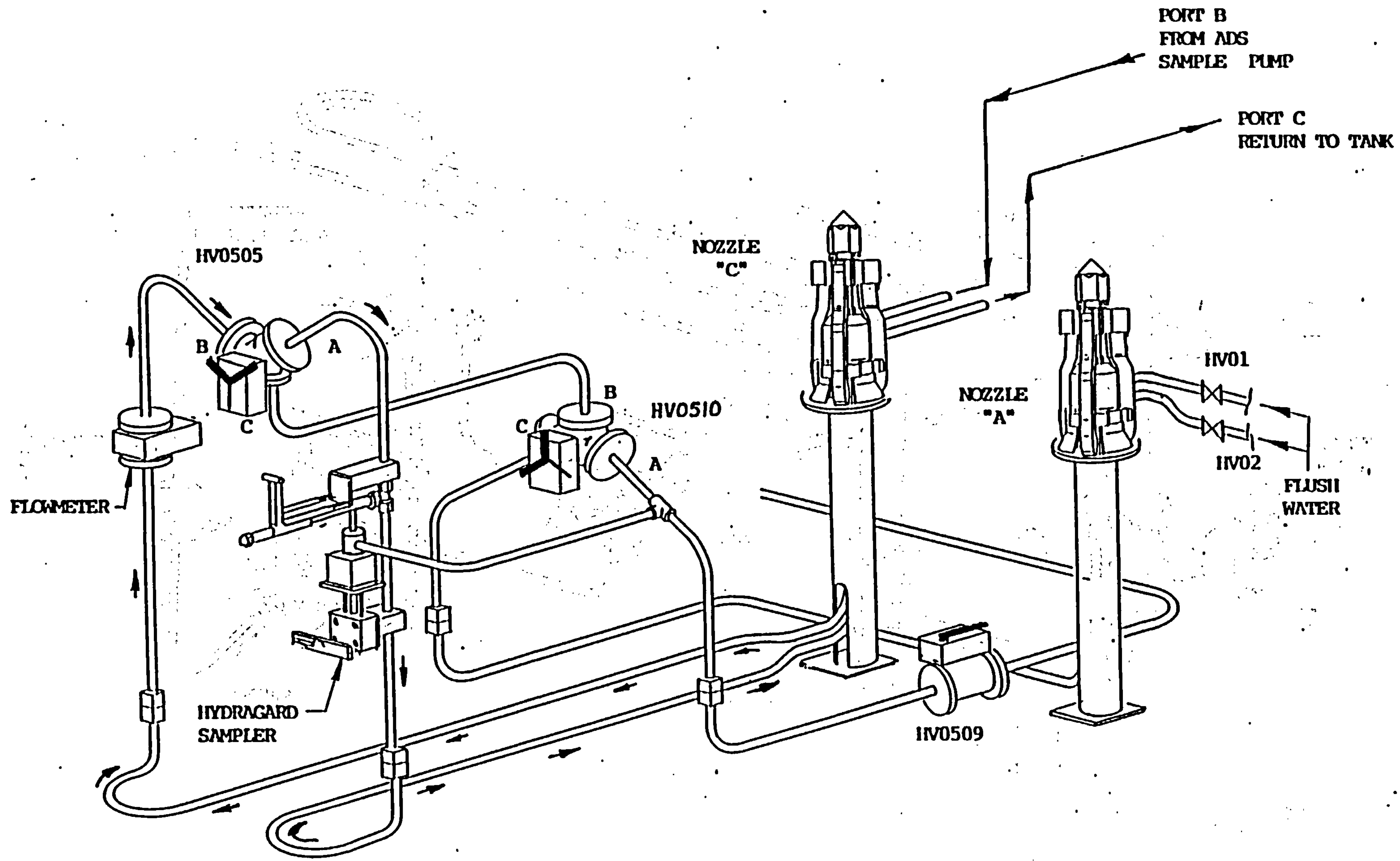

PORT B
FROM ADS
SAMPLE PUMP
PORT C
RETURN TO TANK
HV0505
NOZZLE
"C"
B
A
C
HV01
NOZZLE
"A"
B
HV0510
C
A
HV02
FLUSH
WATER
FLOWMETER
HYDRAGARD
SAMPLER
HV0509

FIGURE 39

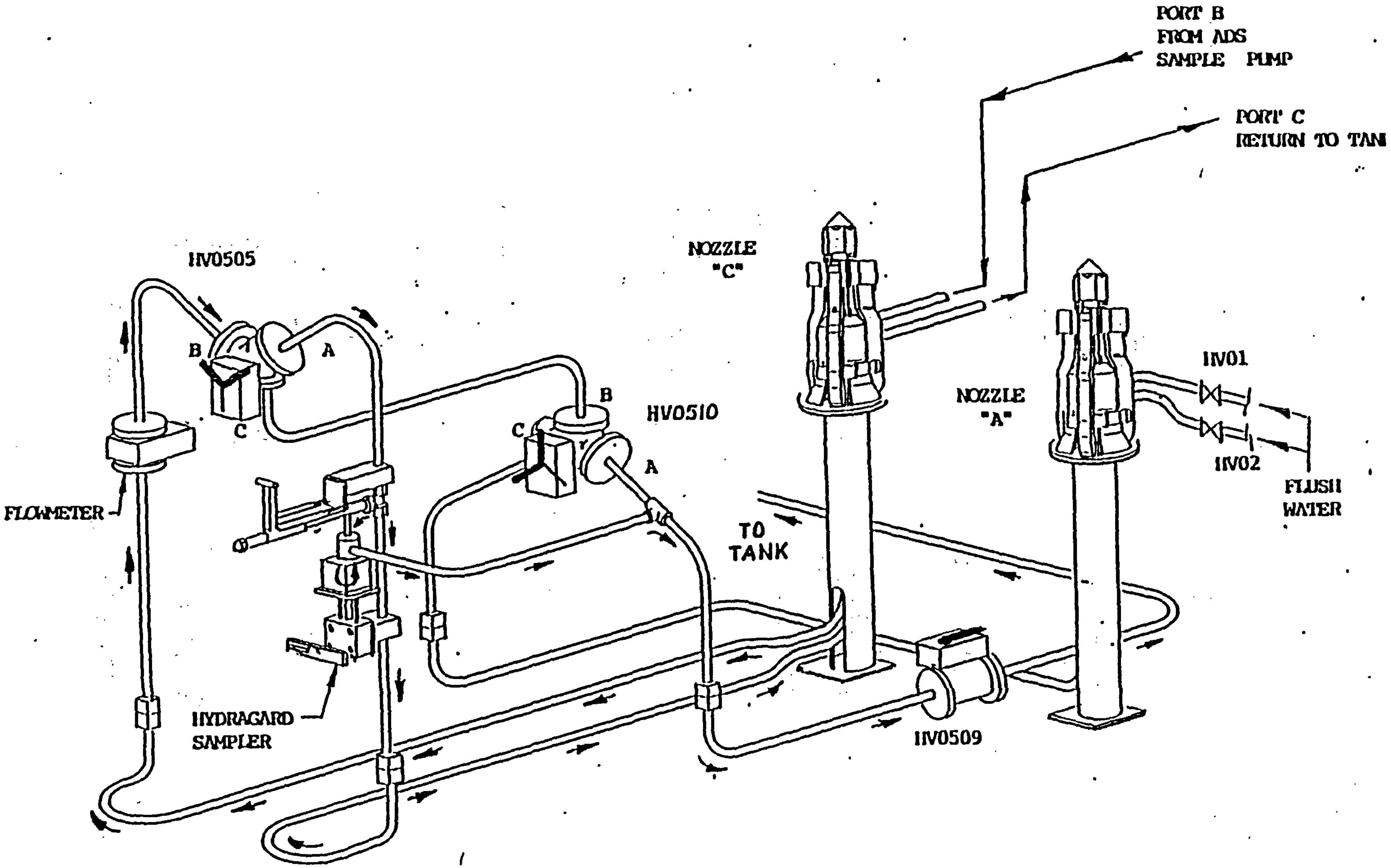

PORT B
FROM ADS
SAMPLE PUMP
PORT C
RETURN TO TAN
HV0505
B
A
C
NOZZLE
"C"
HV0510
B
C
A
NOZZLE
"A"
HV01
HV02
FLUSH
WATER
FLOWMETER
TO
TANK
HYDRAGARD
SAMPLER
HV0509

FIGURE 10

indicator. When the indicator is showing flow, pull back steadily on the handle until it reaches its full extent of travel. Hold the handle back until the flow has stopped and then 3 seconds longer. Then return the handle to its closed and locked position, and remove the sample vial.

- Place another sample vial in the hydragard and its ready for another sample.

8.7.4 Flush

Flushing the sampler and feed lines is an important part of the system, to insure proper operation and nonbias samples. The flush mode will be used on three specific occasions A, after sampling B, before turning pump off, and C before turning pump on. The flush sequence will require communication between the operator at the sample station and the control room. The operator at the station will be responsible for timing the flush and directing the control room to operate the pump.

The following steps 3.3.1 through 3.3.7 explain the flush mode. Before beginning, place a vial in sampler as noted in paragraph 3.2.3.

- Direct control room to turn pump off.
- Adjust valve HV0505 to CA. See figure 41.
- Open valve HV01 for 15 seconds. While timing 15 seconds, pull back on sampler handle to allow flush water to clean out the sampler. When time has lapsed, close sampler then close valve HV01.
- Adjust valve HV0505 to CB. See figure 42.
- Direct the control room to turn on pump flush mode. (Poppet centered) at HIN-0120 or HIN-1120.
- Direct the control room to turn pump flush water "on" HIN-0104 or HIN-1104. Wait 3 seconds and turn on valve HV01. Leave valve open for 15 seconds then close. After closing, direct control room to turn "off" pump flush water.

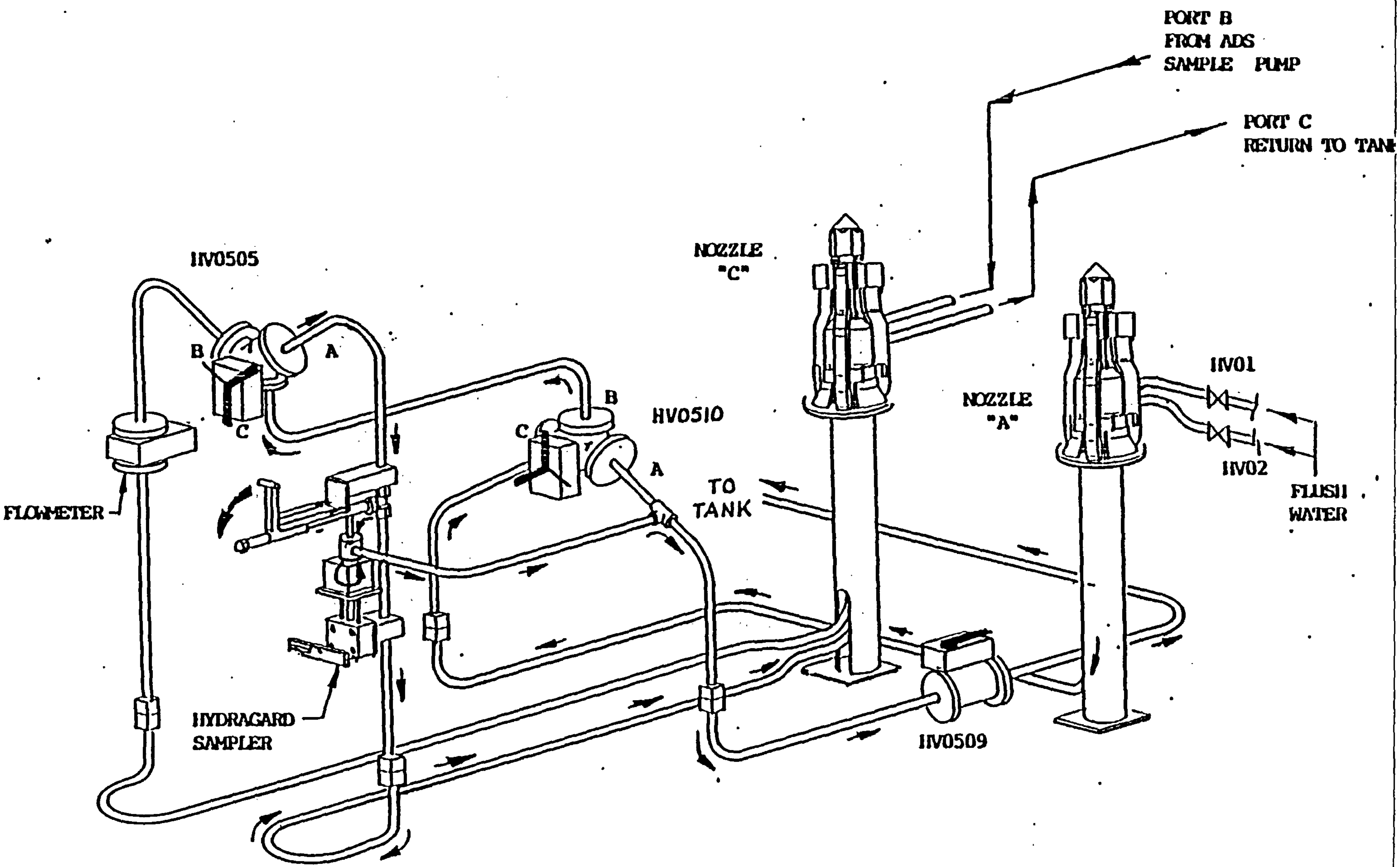

PORT B
FROM ADS
SAMPLE PUMP
PORT C
RETURN TO TAN
HV0505
B
A
C
NOZZLE
"C"
NOZZLE
"A"
HV01
HV02
FLUSH
WATER
B
HV0510
C
A
TO
TANK
FLOWMETER
HYDRAGARD
SAMPLER
HV0509

FIGURE 41

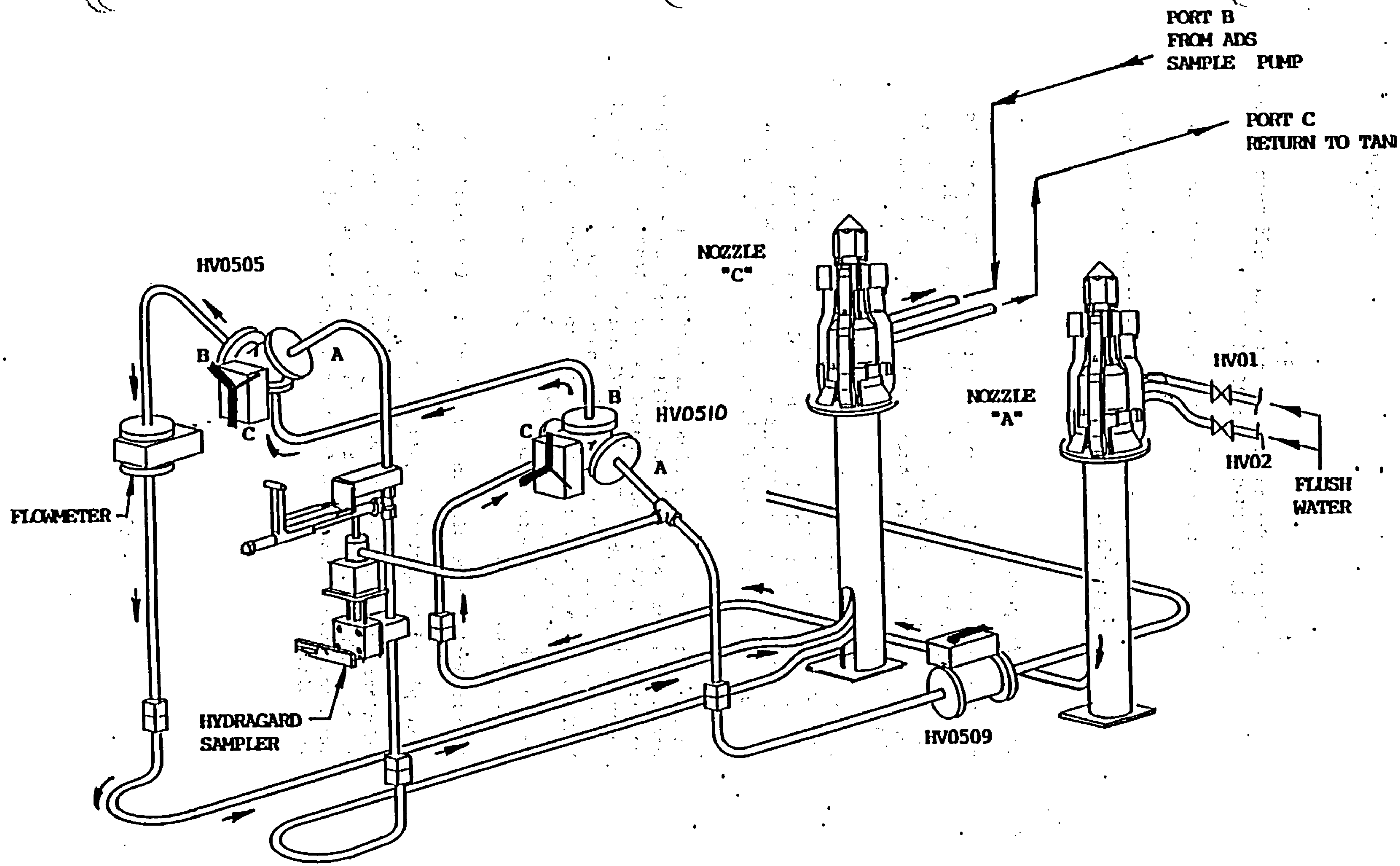

PORT B
FROM ADS
SAMPLE PUMP
PORT C
RETURN TO TAN
NOZZLE
"C"
NOZZLE
"A"
HV0505
B
A
C
HV0510
B
C
A
HV01
HV02
FLUSH
WATER
FLOWMETER
HYDRAGARD
SAMPLER
HV0509

FIGURE 4 2

- Direct the control room to turn off pump flush mode at HIN-0120 or HIN-1120.
- Remove the sample vial and replace with a new one.
- The system is now clean and ready for the next operation.

8.8 Sampling

8.8.1 Sampling Frequency

Samples will be obtained per Section 8.8.3. The specific sampling points and frequency are found in table 8. Samples will be sent to the analytical labs for chemical analysis per the Shift Engineer. Additional sample requirements shall be cleared by Analytical personnel.

Prerun samples will be taken for all vessels so indicated in the check list, or the vessel shall be verified as empty (below a nominal sample heel) see Table 8 and figure 31. The sample log entry shall indicate that the sample is a prerun sample and the vessel level or volume shall be recorded.

To facilitate post run analysis of sample results, a computer generated sample log will be used together with the normal log. A RS/1 Group procedure, #VIT_SAMP is used to generate log numbers. To make RS/1 more accessible for all users the VITOPS account will also have a local procedure VITS for sample numbers. The table can be found at #@VIT_SAMPLE@LOG_S12. Analytical sheet numbers will be assigned by the program. The sample types and codes are listed in table 9.

Sample Analysis requirements are enclosed in Appendix A.

A completed Analytical Request Form shall accompany each sample or group of samples. Modification of an already submitted Request shall be done by resubmitting a corrected form. A&PC will not accept verbal request. Written documentation is required in order to prevent confusion and ambiguity.

TABLE 8: SAMPLE SUMMARY

LOCATION	SAMPLE BEFORE START OF RUN	SAMPLING FREQUENCY	ANALYTICAL FREQUENCY/PRIORITY(2)
A. Liquid Sampling			
SBS Receiver "V-31K"	Yes	During pump out of vessel.	Run record only
SBS Bed	Yes	Twice/shift during the run and particulate sampling. NOTE: 60 mL sample required for surface tension analysis.	Quick turn analysis for surface tension only will be requested by direction of Cognizant Engineer.
HEME "V-34-S1"	Yes(1)	As required per Shift Engineer.	Run record only
Primary Surge "35001" Tank "B" Sampler or at the pump	Yes	Up to twice a shift to monitor peroxide levels for NO_x control.	Samples to be delivered to the laboratory immediately for peroxide analysis only.
Secondary Surge "35004" Tank "B" Sampler or at the pump	Yes	Up to twice a shift to monitor peroxide levels for NO_x control.	Samples to be delivered to the laboratory immediately for peroxide analysis only.
SCR Pilot Plant (Nitrate and Ammonia Slip)	Yes	As required. (As often as one set every two hours during day and swing shifts.)	Quick turn ammonia analysis is required for process control.
6K Tank	No	As needed for liquid disposal (approximately 5 samples over the course of the run).	Quick turn analysis will be required. Triplicate analysis is required for ICP data.

TABLE 8: SAMPLE SUMMARY (CONTINUED)

LOCATION	SAMPLE BEFORE START OF RUN	SAMPLING FREQUENCY	ANALYTICAL FREQUENCY/PRIORITY(2)
B. Slurry Sampling			
CFMT Hydragard*	Yes 5 samples	None	Run Record 5 analysis/sample on pre-run samples
MFHT Hydragard*	Yes 5 samples	5 samples following slurry transfer from the CFMT	Run Record (5 analysis/ sample slurry transfers and pre-run samples only)
		3 samples every 4 hours	Run record only.
		1 sample per hour except when taking fourth hour samples	Archive only.
MFHT Sink	No	1 sample every 4 hours. Sample to be obtained with the Hydragard sample.	Archive only

* See section 8.8

LOCATION	SAMPLE BEFORE START OF RUN	SAMPLING FREQUENCY	ANALYTICAL FREQUENCY/PRIORITY(2)
C. Glass Sampling			
Ceramic Melter "V-20 and Nozzle I.D."	Yes	5 dip samples prior to run, nozzle A, bulk glass.	Run record only
	Yes	Bottom sample and estimated depth of sludge at beginning and end of run.	Run record only
		Surface and bulk samples per shift engineer.	Run record only
Turntable (air lift) "V-41, Canister, and Air Lift Number"	No	Air lift and take 4 sample bars every air lift (approximately one airlift every 4 hours).	Quick turn analysis is required for ferrous-ferric ratio which is needed for process control.

TABLE 8: SAMPLE SUMMARY (CONTINUED)

LOCATION	SAMPLE BEFORE START OF RUN	SAMPLING FREQUENCY	ANALYTICAL FREQUENCY/PRIORITY(2)
D. Gas Sampling			
01-14 at 2nd Floor before (01-FR-1T), between (01-P168/01-P582) and after (DOP-01-P256) NO_x Scrubbers	No	On-line NO/NO_x analyzer will monitor the listed points one at a time per the Shift Engineer. Analyzer will provide NO and NO_x simultaneously at any selected point.	On-line.
E. Particulate			
Melter off-gas jumper V-20(c) to V-31(a), SBS	No	Particulate samples will be pulled per appendix C and Test Engineer.	Run record only
between STS V-31 and HEME T-34			
between HEME T-34 and HEPA T-37			
F. Other			
Samples pulled as directed to enhance understanding of potentially new or uncertain developments		As required	Run record only

TABLE 9

SAMPLE IDENTIFICATION

ENTER	SAMPLE	SAMPLE IDENTIFIER	LOCATION
1	FEED - 11K	OFST	D18
2	FEED - CFMT DIP	CFMT	V01-F
3	FEED - CFMT HYDRAGARD	CHYD	V01-Q
4	FEED - MFHT DIP	MFHT	V11-?
5	FEED - MFHT SINK	SINK	V11-S
6	FEED - MFHT HYDRAGARD	HYDR	V11-S-H
7	FEED - FRIT	FRIT	V20-A
8	GLASS - AIRLIFT	AIRL	V41-N
9	GLASS - DIP	SFCM	V20-?
10	GLASS - SHARD	SHRD	V41-?
11	SBS - BED	BED	V31-V
12	SBS-RECEIVER	REC	V31-K
13	HEME	HEME	V34-S1
14	HEPA	HEPA	V37-
15	PRIMARY SURGE	PSRG	D62-
16	PRIMARY COLLECTION	PCOL	D67-
17	SECONDARY SURGE	SSRG	D72-
18	SECONDARY COLLECTION	SCOL	D77-
19	6K TANK	6K	6K
20	SCR NITRATE	SCR	V47-
21	SCR AMM SLIP	SLIP	V47
22	MISCELLANEOUS	MISC	'?'
23	DISPLAY LOG		
24	'EXIT'		

Question marks will be filled in interactively on logging.

8.8.2 Particulate Sampling

Sampling will be conducted following SOP 63-15 or by an outside vendor. Contractor work is controlled by ARs approved procedure. The sampling plan is enclosed as Appendix C. The plan may be updated by the cognizant engineer during the run.

Particulate samples will be taken in the CTS before and after the locations of the submerged bed scrubber, the high efficiency mist eliminator. These samples will be taken with either Gelman filters or impactor sampling assembly.

8.8.3 General Requirements

8.8.3.1 The sampling personnel shall have safety equipment including safety shield or safety glasses and gloves while taking samples (01-14 B-sampler box provides alternate protection).

8.8.3.2 The sampling bottles shall be 60 mL wide-mouth, high density polyethylene (HDPE) bottles or available alternate approval by the shift engineer. 01-14 "B" sampling bottles are normally 120 mL glass sample bottles, warehouse stock number #0023003.

8.8.3.3 Each sample taken shall be documented in the sampling log book under columns for the location, date, and time, the feed rate, the person sampling, a separate column whether the sample was analyzed, and the last column for any observations during the sample or after the sample was taken. The log book shall be maintained in the CTS building for documenting the samples taken. Location of sample should be referenced by vessel number or pipe location.

8.8.3.4 The procedure for taking a liquid sample will be the following:

a. Recirculating samplers shall recirculate for a minimum of 15 minutes before sampling.

b. The sample lines shall be flushed with at least three sample bottle volumes or three times the equivalent sample line volume before collecting a sample. This procedure should be done by using a dedicated "waste" sample bottle.

NOTE: This is done automatically by the Hydragard Sampler.

After three volumes have been allowed to flush from the sampling port, the sample shall be taken and the cap secured to minimize any leakage. Not only shall the sample be recorded in the log book, but the sample bottle should be labeled as to the location, date, time, and operator taking the sample.

c. The actual time that the sample is taken is to be recorded.

8.8.3.5 Polyethylene vials or zipper seal bags (8" x 5" or 12" or 9") will be used to collect solid (e. g., deposits) samples and will be documented as to location, date, time, and collector. Sample collection with a spatula is to be utilized in order to minimize contact with hands and to minimize contamination of deposit samples.

8.8.3.6 Sample location shall be by equipment number and nozzle, line number, or by additional codes. Photograph can be inserted into the log to help define location and/or circumstance. Building locations will be coded "O" and canister samples will be coded "G" with the canister number. See table 8 for commonly used sample location numbers.

8.8.4 Sample Locations

8.8.4.1 CFMT, MFHT, And Feed Makeup Tank

Samples will be taken only when the feed is being directed to the ceramic Melter. The feed will be pumped to the Melter by the ADS pump and a grab sample taken off the feed line. Additional samples will be taken from the CFMT and MFHT by the SSS, see section 8.8.

8.8.4.2 Ceramic Melter

Cold cap and/or glass samples are to be taken from the melter and cooled to ambient temperature without using water as a cooling medium. Sampling the melter requires a melter power shutdown and will be taken on a "as requested" basis. Samples shall be cooled down to ambient temperature by supporting on or in a metal container. These samples shall not be placed upon fiberglass insulation or any surface that can contaminate the sample while cooling. After the sample has cooled, a sample portion of the cold cap or glass shall be collected in a plastic bag and labeled as to the location (V20 and nozzle number), date, time, sample identification, and the sampling operator.

8.8.4.3 The Submerged Bed Scrubber (SBS)

The liquid samples that will be taken should be identified as to whether it is from the scrubber, or from the condensate receiver. When this sample is taken from the submerged bed scrubber area, three volumes shall be drained from the sampling port before a sample is taken, identified, and documented.

8.8.4.4 High Efficiency Mist Eliminator

The sampling location will be at the bottom of the pit where a drum will be positioned to collect condensate, sample and pump to the receiver, or as directed by the VOSS. Take samples from the seal water container overflow. The sample identification V-34-C, location, date, and time shall be documented.

8.8.4.5 Off-Gas Treatment Building 01-14

Samples shall be taken at the primary NO_x scrubber, which is a packed column, and the secondary NO_x scrubber, which is a bubble cap. Samples that are to be taken either during the test or after the test shall be identified in the log book and on the sample container as to the sample identification, location, date, time, and the person sampling. Sampling locations will be at for the primary and secondary NO_x scrubbers surge tanks and identified as "64-D01" and "64-D03," respectively. Samples can be taken from the B-sampler on the 01-14 second floor or at the recirculation pump outlet. SOP 15-4 will be used as a guide for B-sampler operation.

8.8.4.6 Turntable Bellows

Samples shall be taken of the melt going into the receiving canister at the sampling bellows using a graphite boat. The glass samples will be removed from the graphite boat after cooling. After cooling to ambient temperature, the glass sample will be secured in a plastic zipper bag and/or a tin container identified with the location number (which will be V-41), date, time, sampling operator, receiving canister number. Samples can only be taken during a glass pour/airlift operation. Three bars shall be taken starting approximately ten (10) minutes after the start of a pour. Additional samples will be taken at the direction of the Shift Engineer.

8.8.5 Off-Gas Sampling

8.8.5.1 In-Line NO_x Analyzer

NO and NO_x concentrations are given by this continuous analyzer. It shall be operated per SOP 63-3.

8.9 Melter Solids Cup

To quantify the extent of the solids or various second phases settling in the melter, a cup or boat will be inserted into the bottom of the melter. The boat has a low profile to avoid interference with the electrode heating system.

The boat will be located below Nozzle A prior to the start of the run. It will be retrieved after the run has been completed. The cup will be analyzed for the quantity and type of solids present.

8.10 System Mass Balance

To better trace system components, a checklist/data sheet, figure 43, will be used at start up and shut down to log vessel columns and concentrations.

8.11 CFMT Feed Transfer

Minimum level for effective feed delivery from the MFHT is 23 inches. Prior to the tank level reaching that point, feed will be transferred from the CFMT. The tank contents can be transferred from the CFMT to the MFHT in approximately 30 minutes. Samples will be taken during transfer to assess homogeneity.

STARTUP/SHUTDOWN
MASS BALANCE CHECKLIST

Date: ____________________
Initial ____________________

VESSEL	VOLUME	LEVEL	SAMPLE ID	COMMENT
Feed Storage (D18)				
CFMT				
MFHT				
West Garage				
East Garage				
6,000 Gallon Tank				
Feed Drum				
SBS Bed				
SBS Receiver				
HEME Condensate				
Trench Condensate				
Primary Surge				
Secondary Surge				
Primary Collection				
Secondary Collection				

FIGURE 43

Sample numbers for the samples described below shall use the following format:

M - B1 - T - N

where;

M is the sampler, HYDRA or RECIRC

B1 is the batch number B2 for second feed batch

T is the sample set, T = 1 for the pre-transfer

N is the sample serial number

The following procedure will be used to make the transfer:

1. check available volume in the CFMT for transfer. (Empty CFMT down to the jet heel.)

2. Enter pretransfer vessel levels on figure 27, Transfer Data Sheet.

3. Take samples from the CFMT using the Hydragard sampler per section ____ in rapid succession during the transfer.

4. Jet the CFMT volume to the MFHT from HIN-0115 in the DCS, Micon 10, Bonus tag 1.

5. Enter the post transfer vessel levels on figure 27, Transfer Data Sheet.

6. Take five samples from the MFHT using the Hydragard.

8.12 Redox Adjustment

If the ferrous-ferric ratio result from the lab is higher than the range in Melter Run Sheet, all subsequent air lift samples shall be brought to the lab as soon as possible after the air lift for fast turnaround. If the RSV is exceeded by 0.1, then more nitric acid should be added to the feed. The following procedure should be followed for the addition of acid.

NOTE: Redox RSV will be adjusted by the SE to account for changes in operation, such as use of the bubbler.

8.12.1 Acid Addition Calculation Data

A. Bulk acid concentration from last acid analysis

A = ___________ moles/L

B. Feed Tank Volume

V = ___________ litres

C. Feed Density

D = ___________ gm/mL

D. Acid Shim Target

S = ___________ ppm as provided by Process Development or Shift Engineer

$$\text{Acid Addition} = \frac{V * D * S}{A * 70,983} \text{ litres acid.}$$

8.12.2 <u>Acid Addition Procedure</u>

1. Personal Protective Equipment: When working with bulk liquid chemicals, the operator will wear a hard hat with face shield, goggles, rubber gloves, and gauntlet gloves, and full vinyl suit (rain gear). All suit openings will be sealed with tape. Pants will be worn over boots to prevent solutions from entering the boots. The safety shower will be tested prior to the transfer. If not operable, notify the supervisor and do not proceed until a safety shower-eyewash is available.

2. The acid addition shall take place using acid compatible carboy, or thick walled tygon tubing attached with double hose clamps to a barbed fitting on the sample drain of Nitric Acid tank 65D-05.

3. The transfer will take place between the Temporary Cold Chemical area and the receiving vessel (V-11), located approximately 25 feet from the acid tank.

4. The transfer area will be cordoned off and monitored to ensure personnel not involved with the transfer stays clear.

[+] 5. Verify the eyewash/shower station in the Temporary Cold Chemical area on East 100 foot level is operable.

6. If less than 50 litres of acid are to be transferred, fill a carboy to the desired level from the Nitric Acid Tank sample tap, and slowly pour acid into the MFHT.

7. Run the heavy walled tygon tubing from the barbed nipple to V-11. Securely fasten the nipple with two (2) stainless steel hose clamps.

[+] 8. Secure the tygon tubing inside V-11 to ensure it can not work itself out, or be inadvertently pulled out during acid transfer. Turn off V-11 agitator during transfer. ______________

[+] 9. Obtain and record initial level in 65D-05. ______________

[+] 10. Supervisor verify required finishing level in 65D-05 based upon an HNO_3 addition of ________ litres. ______________

Finishing level ____________

11. Station an operator at the drain valve location to provide quick shutdown. This operator shall be able to communicate with the operator at the V-11 tubing tie off area.

12. Crack open drain valve on tank 65D-05 to establish flow. Verify no leakage exists prior to increasing flow.

13. Throttle drain valve on tank 65D-05 to regulate flow to take approximately 30 to 60 minutes for addition.

14. Monitor acid addition work site with a portable NO_x monitor. Stop acid addition if 3 ppm NO_x is exceeded and notify the supervisor.

15. Upon transfer of required acid, close drain valve.

16. Remove tubing from barbed connection and flush tubing to V-11 using demineralized water.

17. Store tubing in plastic covered pail and label "NITRIC ACID TRANSFER HOSE."

[+] 18. Remove barbed hose fitting and re-install stainless steel cap on end of drain line. Lock and tag drain valve shut. ____________

[+] 19. Record final level in 65D-05. ____________

8.13 Interval Halving

The technique of interval halving may be used to find the proper level of a parameter. The parameter is adjusted half-way between the present value and the assumed target. Response values are watched. The melter power is adjusted and response by the glass thermocouple is monitored.

If the response exceeds limits, the parameter is adjusted half-way back to the original value. If the response has not exceeded limits, the parameter is again adjusted half-way toward the target.

As this procedure is repeated, adjustments will seek the proper level of the control parameter.

NOTE: The VOSS/SE shall closely monitor parameters and take appropriate action to ensure desired limits are not exceeded. Internal halving is a search technique and does not preclude prudent steps to keep parameters within bounds.

9.0 SHUTDOWN PROCEDURES

This operational check list should be followed in the shut down of the melter and support systems and placing the melter into an "idle" state. Completed check lists should be submitted to the Vitrification Operations Shift Supervisor for review and retention. Deviations from this check list should be annotated by the Supervisor in writing.

9.1 CFMT Boildown - Steam Shutdown

When the boildown must be interrupted, the following steps will secure the system for overnight hold. If the target volume has been reached, section 8.0 must also be completed.

9.1.1 Sign off the following steps on the "Shutdown Signoff Sheet," attachment 4.

[+] - Check that HIN-101A and HIN-103A have both been put to "off;" this closes the steam supply and condensate valves. Then set FIC-101A and FIC-103A to manual at zero output; this only ensures that the set points are at minimum for the next boiling operation. ____________

[+] - In order to set up for CLCW to the CFMT put HIN-101B and HIN-103B to "on." This allows TIC-101B to operate autovalve FV-0101B via FY-101B, and TIC-103B to operate autovalve FV-0103B via FY-103B. ______________

[+] - In order to allow CLCW to exit the CFMT, manually open GT-091 for the side jacket and GT-092 for the bottom jacket cooling water. Then the outputs of TIC-101B and TIC-103B can be increased to provide the flow designated by the VOS. The limiting factor is the temperature of the CLCW system, i.e. the operator should check the CLCW temperature to ensure that the heat load added does not cause the system to overheat (the system should stay below approximately 45°C). ______________

[+] - Continue cooling until the CFMT temperature is below 80°C and adjust TIC-101B and TIC-103B per the VOSS. If cooling water is to be secured, then decrease the outputs of TIC-101B and TIC-103B to the run values. Put HIN-101B and HIN-103B to "off." Manually close GT-091 and GT-092. The pressurizers will stop cycling shortly after these valves are closed, unless there is a leak in the system. ______________

NOTE: GT-091 and GT-092 should only be open to:

o clear a jacket to CW
o during cooling of the CFMT

[+] - Reset the MFHT/CFMT emergency vent alarm and return the vessel vent inleakage to the run sheet value. ______________

[+] - Record level of the CFMT. ______________

9.2 At the completion of concentration, the following additional steps are required to secure the system for an indefinite period.

[+] 9.2.1 Notify the PSO supervisor of the intended change and close both the inlet and the outlet cooling water valves for the condenser. ______________

[+] 9.2.2 Close the jacket steam supply valves, GT-051 and GT-056. Lock and tag these valves. ______

[+] 9.2.3 Close the jacket condensate outlet valves, HV-15-L and HV-5-0. ______

[+] 9.2.4 Pump any remaining liquid from the condensate collection pot to one of the TCCMU tanks, and then to the 11K tank. ______

[+] 9.2.5 Repeat steps 6.3.1 through 6.3.5 to transfer the final condensate batch. ______

[+] 9.2.6 Obtain three 60 mL samples from the 11K tank. ______

[+] 9.2.7 Valve in cooling water to the CFMT per the direction of the VOS. ______

9.3 <u>Stop Feeding and Cold Cap Burn Off</u>

9.3.1 Feed off - flush feed nozzle and shut down slurry feed pump. ______

9.3.2 Valve out demin water to ADS pump. ______

9.3.3 Ensure sufficient space remains in canister under pour spout for final air lift. ______

9.3.4 Perform final air lift to reduce level and minimize dripping upon removal of melter vacuum. Shift engineer to recommend final melter level. ______

9.3.5 Valve out, lock and tag shut, air lift air supply. ______

9.3.6 Take final samples per sampling plan. ______

9.3.7 Remove feed nozzle, inspect, photo, and store per supervisor's instructions. ______

9.3.8 Decrease discharge heater temperatures to idle settings. ______

9.3.9 Decrease discharge heater output limits per the shift engineer. ______

SHUT DOWN OF NO_x SCRUBBER SYSTEM

When the melter feed has been stopped and the residual nitrates have been "burned off" from the melter, as characterized by a bright red appearance and plenum temperature, the scrubbers may be shut down per the shift engineer. The plenum must be at >800°C for two hours before the melter is disconnected from the off-gas system.

9.3.10 Melter plenum >800°C for two hours. __________

9.3.11 Turn off primary and secondary recirculation pumps. Shut suction and discharge valves. __________

9.3.12 Lock out pumps per supervisor's direction. __________

NOTE: Cooling water to the coolers will normally be left aligned at 100 percent flow to minimize transients to the main plant cooling water systems. __________

9.3.13 Shut down HEME preheater by reducing output (MICON 1 LOOP 7) to 0 percent and opening breakers at MCC #1 (breaker 3C) and the power supply breaker at south wall of CTS. __________

9.3.14 Shut off steam to HEPA preheater if in use by adjusting TIC-3611 to 0 percent output (MICON 1 LOOP 6.) Close hand valves at inlet to PCV-3611. __________

SHUT DOWN OF CTS OFF-GAS SYSTEM

9.3.15 Valve out steam to the IRTV periscope at Rack 5. __________

9.3.16 Remove the IRTV periscope and sealing gasket and shut off all cooling air once the camera has cooled. __________

9.3.17 Adjust alarms on melter pressure control loop to: "High" = +0.5 inches w.c. and "high-high" = +1.0 inches w.c. __________

9.3.18 Coordinate shut down with blower. Shut down 9.3.23 through 9.3.33 or with CTS isolation. Close hand isolation valves for air injection and film cooler air. ____________

9.3.19 Remove off-gas jumper and cover opening at SBS. ____________

9.3.20 Remove film cooler and insert nozzle plug. ____________

9.3.21 Close melter view ports. ____________

9.3.22 Remove the melter solids cup from below Nozzle A. ____________

- Power down melter prior to removing cup. ____________
- Insert removal tool down Nozzle A, drawing it North, and slide it under the cup centered on A. ____________
- Pick up cup slowly and remove from melter. ____________
- Restart melter power per Vitrification Standing Instructions. ____________

BLOWER SHUT DOWN

The blowers can be shut down anytime after the nitrates have burned off the melter and the HEME Preheater has been shut down; however, the IRTV must be removed and preparations should be made to remove the film cooler and off-gas jumper as soon as possible (within one hour) after flow has been stopped.

Coordinate blower shut down with the CTS control room operator.

9.3.23 To stop the electric blower without having diesel coming on-line, switch the diesel auxiliary panel setting to "off". Press the electric blower "stop" button. ____________

9.3.24 To stop the diesel blower without intending the electric blower to come on-line, switch the electric blower to "off". Switch the diesel auxiliary panel setting to "manual test", reduce engine speed to idle for a few minutes before moving the throttle control to its previous position. ______

9.3.25 Close the HEPA butterfly valve in use (BU 132 or 133). ______

9.3.26 Close the 8 inch main stack isolation valve and open the drain. Lock and tag the isolation valve per the supervisor's instruction. The drain valve is to remain open. ______

9.3.27 Open and leave open both blower casing drain valves (GT 137 and 140). ______

9.3.28 Shut demineralized water supply valves to both blowers (GT-024, 148A, and 148B). ______

9.3.29 Place the hand switch adjacent to relay box K-1-RP-1 (southwest corner of fourth floor) in the "off" position. ______

9.3.30 Close reheater steam supply valves (GT-122 and 125). The condensate return valves can be left open (GT-121 and 124). ______

9.3.31 Place the Moore controllers into the "manual" mode. ______

9.3.32 Notify UR operator that you no longer require demineralized water for the blowers. ______

9.3.33 Shut down the NO_x analyzer per SOP 63-3. (This can be done anytime after nitrate burn off). ______

9.3.34 Stop process log per SE. ______

9.3.35 Change data historian recording interval per SE. ______

9.3.36 Return EMOA alarm to service. ______

9.3.37 Valve out cooling to the SBS when bed and receiver temperatures are <30°C. ______

9.3.38 Valve out cooling to the turntable when the canisters have cooled to <30°C or after canisters have been removed, whichever is sooner. ______

9.3.39 Deliver all designated lab samples for analysis. ______

9.3.40 Stow all designated archive samples at TSB. Label the boxes SF-12. ______

9.3.41 Assemble all data sheets and logs and turn in to SE. ______

9.3.42 Take down all video equipment and stow in locker. ______

10.0 DISTRIBUTED CONTROL SYSTEM/INSTRUMENTATION

The Distributed Control System, DCS, controls and monitors the Vitrification process. A Micon system, manufactured by Powell Process Systems, Inc., has been selected for use, and it is the central device in the control system. The system and its basic functions are described in SOP 63-5. The system allows flexibility in output and control functions to provide optimal user interface.

The system and SOP 63-5 allow the user to configure all parts of the system as needed to complete a particular operation. A security key system is used in the Micons to control access to this configuration. To control changes to the configuration, the system password shall not be used. All access will be by key. The keys will be held by the VOSS, System Administrator, and others approved by the Vitrification Test Group Manager.

This section describes the configuration control, identification, and calibration of instruments, and information output from the DCS. These items then define the instrumentation and control of the Vitrification process.

10.1 Configuration Control

The DCS configuration is modified and documented through the DCS Central Communicator, as described in SOP 63-5. The Central Communicator holds copies of the configuration on 5 MB memory disks as part of the system. The initial data disk configured for the

Data historian shall include the up to date configuration of the DCS for the run. A copy of all historian disks used for the run will be kept for the run record.

To complete the record of the configuration, hard copies of the before and after configurations shall be made, and will also become part of the run record (see section 10.5). The "after" hard copy will be signed by the person making the change, who will also add a description of the change. The VOSS shall also initial any changes done by others during his/her shift.

The change will be checked, and signed, by the System Administrator or an Instrumentation Engineer familiar with the system. If the change occurs during the run, it shall be checked within 24 hours.

10.2 Instrument List

The DCS Historical Report, included as appendix B, provides a list of instrument tags which may be used during the Run. Each instrument with an "A" status shall be checked to be "live", connected to the proper element or process line, and with the exception of flow transmitters (designated FT-XXX), all transmitters shall carry a valid, green tested tag, indicating that the unit has been calibrated to the manufacturer's instructions.

NOTE: For the purposes of the instrument check, the list, sorted by status and location will be used to facilitate this check.

1) All purged air sensing lines shall be blown down prior to the test.

   a. Once the blower is operating. Open the bypass and close isolation valves at the transmitter manifold.

   b. Increase purge air to full scale. Sluggish response could indicate a line plug or partial plug.

   c. Return air flow to normal then open the isolation valves and close the bypass valve.

2) Open unpurged instrument lines (CTS off-gas) while under vacuum to clear and reconnect.

   The control room list of instruments shall be marked and initialed to indicate operable instruments.

   NOTE: Critical instruments are checked as part of the start up check list.

10.3 Data Historian

The DCS Historical Report also provides the location at the point in the Micon's controller and the Data Historian (DH) location. The Vitrification Test Engineer shall set the DH to store points at a rate between once a minute at once every five minutes. The data is collected on 5 MB disk for later recall. Historian Disks 1 and 3 will be left in circular mode whenever possible. All historian disks used for the run shall be initialed with the run system configuration.

10.4 Process Logs

The DCS will generate logs which will be checked against Run Sheet Values and earlier data and signed by the CTS Operator as a substitute for manually collected data. Data outside the acceptable ranges will be corrected for and/or logged in the log book.

Process logs will be set up and initialized prior to initiating feed to the melter. Table 10 provides a minimum list of tags to be in the log.

10.5 Data Disposition

Copies of the following information shall be sent to MRC for permanent retention:

1) Test request and Test Procedure with test steps signed off.

2) Copies of the Test Log - pages from the Vitrification Operations Log Book and any other log book used as part of this run. (Sample Log, DCS Log, etc.).

3) Canister characterization data sheets.

4) Signed off activity diagram.

5) Manual Data Sheets recorded.

6) Completed Analytical requests, tabulated.

7) Checked process log sheets from run (feed) periods.

8) Prerun training attendance sheet.

9) Reports: Morning Reports
Initial Run Summary
Final Run Report

10) Graphical Data Summary

11) Tape of run tag files

12) DCS data historian disk, with system configuration and any updates during the run.

TABLE 10

PROCESS LOG TAGS

PIC-5835	*TIC-2003*	* *	*LT--6701*
PIC-5850	*KIX-2000*	*FT--3401*	* *
HIC-1135	* *	*PT--3401*	*PDT-7101*
LT--1101	*FIC-2013*	*PDT-3401*	*LT--7201*
DT--1101	* *	* *	*LT--7601*
LT--0101	*TIC-2051*	* *	*LT--7701*
LT--0102	*TIC-2061*	*PDT-3501*	* *
PIC-2004	*TIC-2071*	* *	*PT--8101*
FIC-2020	* *	*TIC-3611*	*TT--8101*
* *	*TIC-2034*	*PT--3611*	*TT--8102*
TIC-2031	*TIC-2035*	*PDT-3601*	* *
TIC-2032	*TIC-2037*	* *	*PDT-8601*
TIC-2033	* *	* *	*PDT-8701*
* *	*TIC-3103*	*PDT-3701*	* *
TIX-2039	*FT--3102*	*TT--3701*	*PT--8801*
ZIX-2039	*PDT-3101*	*FT--6101*	*PT--8802*
KIX-2030	*TT--3101*	*PDT-6101*	*TT--8802*
* *	*FT--3118*	*LT--6201*	*TT--8801*
TIC-2001	*LT--3111*	*LT--6601*	*IT--8801*
TIC-2002			

APPENDIX A
PROJECTED NUMBER OF SAMPLES FOR ANALYSIS

Type of Sample	Typical Day Between Feed Transfer	Typical Day During Feed Transfer (once every 5 to 7 days)
Feed	18	50
Glass	18	25
SBS Receiver		1
SBS Bed	6	1
HEME		1
Primary Surge	5	5
Secondary Surge	2	2
NH_3 Slip	4	—
Total/Day	53	84

APPENDIX B
SF-12 INSTRUMENT LIST

TAG	STAT US	MICON DES	DESCRIPTION	MCN NO	MCN TYPE	MCN CODE	RACK NO	HIST.	UNITS
1 HV-0101C	B	SIDE AIR	AIR LINE TO SIDE COIL	9	D	21	5		ON/OFF
2 HV-0102A	B	SID PURG	CONDENSATE BLOCK VALVE S	9	D	22	5		ON/OFF
3 DT--0101	A	BUB DENS	CFMT DENSITY PROBE BUBLE	15	I	8		250	
4 IT--0101	A	AGITATOR	AGITATOR CURRENT	9	I	15	MC	202	AMPS
5 KT--0101	A	AGITATOR	AGITATOR POWER MONITOR	10	I	7	MC	152	KW
6 LT--0101	A	BUB LEVL	CFMT LEVEL PROBE BUBLER	15	I	7		249	INCHES
7 PT--0101	A	STM PRS	SIDE JACKET STEAM PRESSU	9	I	5	5	203	IN WC
8 TT--0101	A	VAPOR	VESSEL VAPOR SPACE TEMP	9	I	10	TR	204	DEG C
9 FIC-101A	B	SIDE STM	SIDE JAC STEAM FLOW CONT	9	L	1	5		LB-HR
10 FT--101A	A	SIDE STM	SIDE JAC STEAM FLOW	9	I	1	5	201	LB-HR
11 HY--101A	B	S CONDEN	CONDENSATE BLOCK VALVE S	9	D	24			ON/OFF
12 FIC-101B	B	SIDE CW	SIDE JACKET COOLING CONT	9	L	2			GPM
13 FT--101B	A	SIDE CW	COOLING WATER FLOW TO SI	9	I	2	1A	205	GPM
14 TIR-2	B	H20-HDR	CLCWS TEMPERATURE OF COO	7	T	1	66		DEG C
15 LT--0102	A	CAP LEV	VESSEL LEVEL WITH CAPACI	10	I	4	FD	232	INCH
16 TT--0102	A	BOTTOMS	VESSEL SOLUTION TEMP	9	I	12	TR	206	DEG C
17 LT--0103	A	LEVEL	LEVEL PROBE 2ND BUBBLER	9	I	9	4	230	IN WC
18 PT--0103	A	BOT STM	BOTTOM JAC STEAM PRESSUR	9	I	6	4	227	PSIG
19 TT--0103	A	BJAC OUT	CW OUTLET TEMP BOTTOM JA	9	I	13	TR	228	DEG C
20 FIC-103A	B	BSTM CNT	BOTTOM JAC STEAM CONTROL	9	L	3	4		LB-HR
21 FT--103A	A	BSTM FLW	BOTTOM JACKET STEAM FLOW	9	I	9	4	226	LB-HR
22 FIC-103B	B	BOTM CW	BOTTOM JACKET COOLING CO	9	L	4			GPM
23 FT--103B	A	BOT CW	COLLING WATER FLOW TO BO	9	I	4	1A	229	GPM
24 TT--0104	A	SJAC OUT	CW OUTLET TEMP SIDE JACK	10	I		TR	244	DEG C
25 HY--104A	B	BOT COND	BOTOM JACK STEAM CONDENS	9	D	25	3B		ON/OFF
26 TT--0105	A	CFMT TEM	CFMT VESSEL TEMPERATURE	9	I	11	TR	248	DEG C
27 DT--0113	B	SPEC GRV	CFMT SOLUTION SPECIFIC G	9	I	8	4	231	SPGR
28 PT--0114	A	PRESSURE	VESSEL OPERATING PRESSUR	9	I	2	4	233	IN WC
29 FIX-0115	B	JET FLOW	TOTALIZE FLOW FM CFMT TO	10	A	1		123	LITERS
30 FT--0115	A	JET FHT	CFMT TO MFHT TRANSFER JE	10	I	6		151	LPH
31 PT--0115	A	V01-V11	PRESSURE TO JET TRANS VO	10	I	2	3A	234	PSIG
32 PDT-0120	A	DEMISTER	DEMISTER PRESSURE DROP	10	I	1	2	243	IN WC
33 PT--0213	B	CADSPUMP	ADS SAMPLE PUMP PUSH PRE	11	I	2	3B		PSIG
34 LIR-300	B	COND POT	CONC. CONDENSATE COLL. P	2	T	4			INCHES
35 LT--300	A	COND-POT	LEVEL CONDENSATE COLLECT	2	I	5		5	INCHES
36 TT--301	A	COND TK	CONDENSATE TANK TEMPERAT	DA		6	TR		DEG C
37 PT--0305	A	VO3-WHDR	PRESS TO JET TO EMPTY SE	10	I	3	3B		PSIG
38 LIN-1001	B	LOLO LVL	CLCWS HOLD TANK LO- LO L	4	D	47			
39 LIN-1002	B	LO LEVEL	CLCWS HOLD TK LO LEVEL A	4	D	48			
40 LIN-1003	B	HIGH LVL	CLCWS HOLD TK HIGH LEVEL	4	D	49			NORMAL
41 DIR-1101	B	CFMUT-SG	TREND CFMUT SPECIFIC GRA	1	T	7	5		SPGR
42 DT--1101	A	MFHT SPG	SPECIFIC GRAVITY OF MFHT	1	I	12	5	8	SPGR
43 LIN-1101	B	AGITATOR	LOW LEVEL INTERLOCK FOR	3	D	51	5		NORMAL
44 LIR-1101	B	CFMUT-LV	CFMUT LEVEL TREND	1	T	6	5		INCHES
45 LIX-1101	B	CALC-LEV	CFMUT LEVEL	1	A	5	5	225	INCHES
46 LT--1101	A	MFHT	UNCORRECTED MFHT DIP PRO	1	I	11	5	9	INCHES
47 PIR-1101	B	CFM-PRES	CFMUT OPERATIONAL PRESSU	1	T	8	5		INCHES
48 LIX-1102	B	CALC LEV	MFHT VOLUME CALC FM ADS	1	A	5		269	LITERS
49 LT--1102	A	CAP LEV	MFHT CAPACITANCE LEVEL P	10	I	5			INCHES
50 LT--1103	A	MFHT BUB	LEVEL PROBE 2ND BUBBLER	11	I				IN WC
51 HIC-1106	B	CHEM-ADD	CHEMICAL ADDITIONTO CFMU	1	L	1	5		ON-OFF

APPENDIX B
SF-12 INSTRUMENT LIST

TAG	STATUS	MICON DES	DESCRIPTION	MCN NO	MCN TYPE	MCN CODE	RACK NO	HIST.	UNITS
52 FIC-1110	B	STEAM	STEAM CONTROL TO CFMUT C	3	L	7	3B		LB-HR
53 FIR-1110	B	STEAM-FL	STEAM FLOW TO CFMUT COIL	3	T	3	3B		LB-HR
54 FIX-1110	B	TOT-STM	TOTALIZED STEAM FLOW TO	3	A	3	3B		LB
55 FT--1110	A	STEAM	STEAM FLOW TO MFHT COILS	3	I	7	3B	12	LB-HR
56 HIN-1110	B	STM-TST	UNLATCH INTERLOCK STM	3	D	56			ON-OFF
57 PIN-1110	B	LO-STEAM	LOW PRESSURE ON CFMUT ST	3	D	55	3B		NORMAL
58 PIR-1110	B	CFM-STM	CFMUT STEAM PRESSURE TO	3	T	4	3B		PSIG
59 PT--1110	A	STEAM	STEAM PRESSURE TO MFHT C	3	I	4	3B	13	PSIG
60 HIN-1111	B	AGITATOR	CFMUT AGITATOR ON/OFF	3	D	49	MC		ON-OFF
61 IIR-1111	B	AGIT	CFMUT AGITATOR CURRENT	1	T	2	MC		AMPS
62 IT--1111	A	AGITATOR	MFHT AGITATOR CURRENT	1	I	2	MC	14	AMPS
63 KT--1111	A	AGITATOR	MFHT AGITATOR POWER MONI	10	I	8	MC	153	KW
64 PIN-1111	B	LO-STEAM	LOW PRESSURE OF HEPA PRE	1	D	48	4		NORMAL
65 TIC-1111	B	LIQUID	TEMPERATURE CONTROL OF C	1	L	5	3A		DEG C
66 TIN-1111	B	START		1	D	56			NORMAL
67 TT--1111	A	LIQUID	MFHT LIQUID TEMPERATURE	1	I	5	TR	15	DEG C
68 UIN-1111	B	STM-LOCK		1	D	50	TR		ON-OFF
69 TIR-1112	B	VAPOR	CFMUT VAPOR TEMPERATURE	1	T	1	TR		DEG C.
70 TT--1112	A	VAPOR	MFHT VAPOR SPACE TEMPERA	1	I	1	TR	16	DEG C.
71 TIR-1113	B	H20-OUT	CLCWS CFMUT OUTLET TEMPE	1	T	3	TR		DEG C.
72 TT--1113	A	H20-OUT	MFHT COOLING WATER EXIT	1	I	3	TR	17	DEG C
73 FIR-1119	B	COOL H20	CLCWS FLOW TO CFMUT	1	T	5	3A		LB-HR
74 FIX-1119	B	TOTCLCW	TOTALIZED CLCWS FLOW TO	1	A	4	3A		GPM
75 FT--1119	A	MFHT-CWS	COOLING WATER FLOW TO MF	1	I	8	3A	18	GPM
76 PT--1121	A	JET-8D-2	STEAM PRESS TO JET TO 8-	2	I	14			PSIG
77 FIR-1125	B	FEED FLO	ADS PUMP FEED FLOW TREND	2	T	2			LPH
78 FIX-1125	B	ADS TOT	TOTALIZED FLOW FROM ADS	1	A	1		10	LITER
79 FT--1125	A	FEED FLO	FEED FROM ADS PUMP	1	I	15		6	LPH
80 FIX-1126	B	ADS RATE	ADS FEEDRATE CALC FM TOT	1	A	6		84	LPH
81 FIX-1131	B	FEED 2HR	CAL FEED FLOWRATE FROM 2	1	A			251	LPH
82 FIX-1132	B	FEED 15M	CAL FEEDRATE FROM 15 MIN	1	A			252	LPH
83 HIC-1133	B	ADS FILL	ADS FILL VALVE	1	D	47	5		ON/OFF
84 HY--1133	B	ADS FILL	ADS FILL VALVE	5	DO	23	5		ON/OFF
85 HY--1134	B	ADS PIST	ADS PUMP PISTON DRIVE VA	1	DO	24	5		ON/OFF
86 HIC-1135	B	ADS PUMP	ADS PUSH PRESSURE MANUAL	1	L	1	5		PSIG
87 HIC-1139	B	ADS FLSH	ADS WATER FLUSH	1	V	43	5		ON/OFF
88 HY--1139	B	ADS FLSH	ADS WATER FLUSH VALVE	1	DO	21	5		ON/OFF.
89 HV--115A	B	JET V11	TRANSFER JET V01 TO V11	10	D	21	3A		ON/OFF
90 PT--1205	B	MADSPUMP	ADS SAMPLE PUMP PUSH PRE	11	I	1	ADS		PSIG
91 FT--1501	A	VSL VENT	VESSLE VENT GAS FLOW FRO	2	I	8	VV	245	SCFM
92 PDT-1501	A	CONDENSR	VESSEL VENT CONDENSER D	2	I	13	C	246	INWC
93 PIC-1501	B	VES VENT	VESSEL VENT PRESSURE CO	2	L	1	4		INWC
94 PT--1501	A	VES VENT	MFHT/VESSEL VENT PRESSUR	1	I	13	5	11	INCHES
95 LIR-1801	B	11K TANK	OFST LEVEL TREND	1	T	4			INCHES
96 LT--1801	A	11K TANK	LEVEL IN OUTSIDE STORAGE	1	I	4		19	INCHES
97 KIX-2000	B	OVFL PWR	TOTAL POWER TO DISCHARGE	DA		103	SC	103	KW
98 ET--2001	A	DCH HT 1	DISCHARGE HEATER ZONE NO	DA		80	SR	20	VOLT
99 IT--2001	A	DCH HT 1	DISCHARGE HEATER NO. 1 C	DA		81	SR	26	AMPS
100 KT--2001	A	DCH HT 1	DISCHARGE HEATER NO. 1 P	DA		82	SR	27	KW
101 RT--2001	A	DISC ZN1	CALCULATED RESISTENCE IN	DA		95		22	OHMS
102 TIC-2001	B	DISC ZN1	SFCM DISCHARGE HEATERS Z	5	L	6			PCT

APPENDIX B
SF-12 INSTRUMENT LIST

TAG	STAT US	MICON DES	DESCRIPTION	MCN NO	MCN TYPE	MCN CODE	RACK NO	HIST.	UNITS
103 ET--2002	A	DCH HT 2	DISCHARGE HEATER ZONE NO	DA		83	SR	29	VOLT
104 IT--2002	A	DCH HT 2	DISCHARGE SECTION HEATER	DA		84	SR	30	AMPS
105 KT--2002	A	DCH HT 2	DISCHARGE HEATER NO. 2 P	DA		85	SR	31	KW
106 RT--2002	A	DISC ZN2	CALCULATED RESISTENCE IN	DA		96		23	OHMS
107 TIC-2002	B	DISC ZN2	SFCM DISCHARGE HEATERS Z	5	L	7			DEG C
108 TT--2002	A	DISC-W	SFCM DISCHARGE TEMPERATU	4	I	8	TR	46	DEG C
109 ET--2003	A	DCH HT 3	DISCHARGE HEATER ZONE NO	DA		86	SR	34	VOLT
110 IT--2003	A	DCH HT 3	DISCHARGE SECTION HEATER	DA		87	SR	36	AMPS
111 KT--2003	A	DCH HT 3	DISCHARGE HEATER NO. 3 P	DA		88	SR	37	KW
112 PIX-2003	B	JUMP DP	OFF GAS JUMPER DIF PRESS	4	A	1			INCHES
113 RT--2003	A	DISC ZN3	CALCULATED RESISTENCE IN	DA		97		24	OHMS
114 TIC-2003	B	DISC ZN3	SFCM DISCHARGE HEATERS Z	5	L	8			DEG C
115 TT--2003	A	DISC-ZBOT	SFCM DISCHARGE TEMPERATU	2	I	12	TR	48	DEG C
116 FT--2004	A	AIR INJT	AIR INJECTION TO SFCM FO	3	I	2	2	28	SFCM
117 PIC-2004	B	VACUUM	CONTROL OF SFCM OPERATIO	6	L	5	2		PSIG
118 PIR-2004	B	SFCM-PRS	SFCM OPERATIONAL PRESSUR	6	T	2	7B		INCHES
119 PT--2004	A	VACUUM	SFCM OPERATIONAL PRESSUR	6	I	5	7B	32	INCHES
120 FIN-2005	B	LOAIR-TV	LOW COOLING AIR TO TV	6	D	44	10		NORMAL
121 TT--2006	A	FLM COOL	FILM COOLER TEMPERATURE	DA		35		49	DEG C
122 TT--2007	A	OFGASLIN	TEMP IN OFF GAS JUMPER	DA		36		50	DEG C
123 DIR-2008	B	MELTER	TREND SFCM GLASS SPECIFI	6	T	3			SPGR
124 DT--2008	A	GLASS	SPECIFIC GRAVITY OF GLAS	6	I	7	7B	25	SPGR
125 FIN-2008	B	LO-PURGE	LOW INSTRUMENT AIR PURGE	6	D	42	7B		NORMAL
126 LIR-2009	B	SFCM-LEV	SFCM GLASS TANK LEVEL -	6	T	1	7B		INCHES
127 LIX-2009	B	TRU-LEVL	SFCM GLASS TANK LEVEL	6	A	2	7B	33	INCHES
128 LT--2009	A	SFCM	UNCORRECTED GLASS LEVEL	6	I	3	7B	21	INCHES
129 TT--2010	A	NOZ R1	SFCM NOZ R-1 PLENUM	DA		30	TR	38	DEG C
130 FIN-2011	B	LO-PURGE	LOW INSTRUMENT AIR PURGE	6	D	45	7A		NORMAL
131 LIR-2011	B	MELT-OV	SFCM DISCHARGE SECTION L	6	T	6	7A		INCHES
132 LIX-2011	B	TRU-LEVL	SFCM DISCHARGE SECTION L	6	A	6	7A		INCHES
133 LT--2011	A	DISCHLEV	UNCORRECTED LEVEL IN SFC	6	I	13	7A	39	INCHES
134 PDT-2011	A	DP-ML-OV	SFCM DIFFERENTIAL PRESSU	6	I	14	7A	41	INCHES
135 PIR-2011	B	DP-SFCM	DIFFERENTIAL PRESSURE FR	6	T	7	7A		INCHES
136 TT--2011	A	NOZ-R1	SFCM G-AVE R-1 16 IN FM	5	I	3	TR	42	DEG C
137 PIR-2012	B	DISCH-PR	SFCM DISCHARGE SECTION P	6	T	8	7A		INCHES
138 PT--2012	A	DISC VAC	SFCM DISCHARGE PRESSURE	6	I	15	1A	40	INCHES
139 TT--2012	A	NOZ-R1	SFCM G-AVE 18 IN FM BOT	5	I	1	TR	43	DEG C
140 FIC-2013	B	GLAS-LFT	AIR TO SFCM GLASS AIRLIF	6	L	6	7A		SFCM
141 FIN-2013	B	AIRLIFT	HIGH AIR FLOW DESCRETE F	6	D	51			NORMAL
142 FIX-2013	B	AIR-LIFT	TOTALIZED AIR FLOW TO RE	6	A	3	7A		FT3
143 FT--2013	A	AIR-LIFT	AIR TO SFCM GLASS AIR LI	6	I	6	7A	44	SFCM
144 TT--2013	A	NOZ-R1	SFCM G-AVE 20 IN FM BOTT	5	I	2	TR	45	DEG C
145 FIC-2014	B	GLAS-LFT	AIR TO SFCM GLASS AIR LI	6	L	8	9		SFCM
146 FIX-2014	B	AIR-LIFT	TOTALIZED AIR FLOW TO EM	6	A	4	9		FT3
147 FT--2014	A	AIR-LIFT	AIR TO SFCM GLASS AIR LI	6	I	8	9		SFCM
148 TT--2014	A	NOZ-R1	SFCM R-1 22 IN FM BOTTOM	DA		8	TR	51	DEG C
149 FIN-2015	B	LOAIR-TV	LOW COOLING AIR TO TV	6	D	43	10		NORMAL
150 FIR-2015	B	CWS-WALL	CLCWS FLOW TO SFCM JACKE	5	T	4	7A		GPM
151 FIX-2015	B	CWS-WALL	TOTALIZED CLCW TO SFCM J	5	A	3	7A		GPM
152 FT--2015	A	CWS-WALL	COOLING WATER FLOW TO SF	5	I	11	7A	52	GPM
153 TT--2015	A	NOZ-R1	SFCM R-1 23 IN FM BOTTOM	DA		12	TR	53	DEG C

APPENDIX B
SF-12 INSTRUMENT LIST

TAG	STAT US	MICON DES	DESCRIPTION	MCN NO	MCN TYPE	MCN CODE	RACK NO	HIST.	UNITS
154 ET--2016	A	RED/OX	GLASS REDOX POTENTIAL	15	I	5		247	VOLT
155 FIR-2016	B	CWS-BOTM	CLCWS FLOW TO SFCM BOTTO	5	T	5	7B		GPM
156 FIX-2016	B	CWS-BOTT	TOTALIZED CLCW TO SFCM B	5	A	4	7B		GPM
157 FT--2016	A	CWS-BOTM	COOLING WATER FLOW TO SF	5	I	12	7B	54	GPM
158 TT--2016	A	NOZ-R1	SFCM R-1 24 IN FM BOTTOM	DA		13	TR	55	DEG C
159 TT--2017	A	NOZ-R1	SFCM R-1 25 IN FM BOTTOM	DA		14	TR	56	DEG C
160 TT--2018	A	NOZ-R1	SFCM R-1 26 IN FM BOTTOM	DA		15	TR	57	DEG C
161 TT--2019	A	NOZ-R1	SFCM R-1 28 IN FM BOTTOM	DA		16	TR	58	DEG C
162 FIC-2020	B	FILMCOOL	AIR TO FILM COOLER ON ME	3	L	3			SFCM
163 FIR-2020	B	FILMCOOL	TREND FILMCOOLER AIR FLO	3	T	5			SFCM
164 FT--2020	A	FILMCOOL	PURGE AIR TO THE TURNTAB	3	I	3	8	35	SFCM
165 HIN-2020	B	AIR RSET	RESET FILM COOLER AIR SU	3	D	42			ON-OFF
166 PIX-2020	B	OG DIFF	OG JUMPER DIFFERENTIAL C	4	A	1		1	IN WC
167 TT--2020	B	NOZ-R2	SFCM R-2 PLENUM	DA		31	TR	59	DEG C
168 TT--2021	A	NOZ-R2	SFCM G-AVE 16 IN FM BOTT	5	I	10	TR	60	DEG C
169 TT--2022	A	NOZ-R2	SFCM G-AVE 18 IN FM BOTT	5	I	6	TR	61	DEG C
170 TT--2023	A	NOZ-R2	SFCM G-AVE 20 IN FM BOT	5	I	9	TR	62	DEG C
171 TT--2024	A	NOZ-R2	SFCM R-2 22 IN FM BOTTOM	DA		17	TR	63	DEG C
172 TT--2025	A	NOZ-R2	SFCM R-2 23 IN FM BOTTOM	DA		21	TR	64	DEG C
173 TT--2026	A	NOZ-R2	SFCM R-2 24 IN FM BOTTOM	DA		22	TR	65	DEG C
174 TT--2027	A	NOZ-R2	SFCM R-2 25 IN FM BOT 57	DA		23	TR	66	DEG C
175 TT--2028	A	NOZ-R2	SFCM R-2 26 IN FM BOTTOM	DA		24	TR	67	DEG C
176 TT--2029	A	NOZ-R2	SFCM R-2 28 IN FM BOTTOM	DA		25	TR	68	DEG C
177 HIN-2030	B	T RESET	RESET TEMPERATURE AVERAG	5	D	51			ON-OFF
178 KIX-2030	B	ELECTPWR	TOTAL POWER TO SFCM ELEC	DA		101	SC	104	KW
179 ET--2031	A	CKT A EW	MELTER CIRCUIT A	DA		71	SR	69	VOLT
180 FIR-2031	B	ELEC-AIR	COOLING AIR TO BOTTOM SF	7	T	2	6		SFCM
181 FIX-2031	B	ELEC-AIR	TOTALIZED COOLING AIR TO	7	A	1	6		FT3
182 FT--2031	A	BOT ELEC	COOLING AIR TO THE BOTTO	7	I	9	6	70	SFCM
183 IT--2031	A	CKTA EW	METER CIRCUIT "A"CURRENT	DA		72	SR	71	AMPS
184 KT--2031	A	CKTA EW	MELTER CIRCUTA POWER	DA		73	SR	72	KW
185 RT--2031	A	CT A E-W	CALCULATED RESISTENCE IN	DA		92		81	OHMS
186 TIC-2031	B	CT A E-W	SFCM GLASS TEMPERATURE C	5	L	1		127	DEG C
187 TIR-2031	B	TIME AVE	TREND TIME LAG OF AVERAG	5	T	2			DEG C
188 ET--2032	A	CKT B WB	MELTER CIRCUIT B	DA		74	SR	74	VOLT
189 FIR-2032	B	ELEC-AIR	COOLING AIR TO THE EAST	7	T	3	6		SFCM
190 FIX-2032	B	ELEC-AIR	TOTALIZED COOLING AIR TO	7	A	2	6		FT3
191 FT--2032	A	WEST ELT	COOLING AIR TO THE EAST	7	I	10	6	75	SFCM
192 IT--2032	A	CKTB WB	MELTER CIRCUIT B CURRENT	DA		75	SR	76	AMPS
193 KT--2032	A	CKT B WB	MELTER CKTB POWER	DA		76	SR	77	KW
194 RT--2032	A	CT B W-B	CALCULATED RESISTENCE IN	DA		93		82	OHMS
195 TIC-2032	B	CT B W-B	SFCM GLASS TEMPERATURE C	5	L	2			PCT
196 ET--2033	A	CKT C EB	MELTER CIRCUIT C	DA		77	SR	79	VOLT
197 FIR-2033	B	ELEC-AIR	COOLING AIR TO THE WEST	7	T	4	6		SFCM
198 FIX-2033	B	ELEC-AIR	TOTALIZED COOLING AIR TO	7	A	3	6		FT3
199 FT--2033	A	EAST ELT	COOLING AIR TO THE WEST	7	I	11	6	80	SFCM
200 IT--2033	A	CKTC EB	MELTER CIRCUIT C CURRENT	DA		78	SR	86	AMPS
201 KT--2033	A	CKT C EB	MELTER CIRCUIT C POWER	DA		79	SR	87	KW
202 RT--2033	A	CT C E-B	CALCULATED RESISTENCE IN	DA		94		83	OHMS
203 TIC-2033	B	CT C E-B	SFCM GLASS TEMPERATURE C	5	L	3			PCT
204 FIR-2034	B	DAM-COOL	COOLING AIR TO THE REFRA	7	T	5	7A		SFCM

APPENDIX B
SF-12 INSTRUMENT LIST

TAG	STAT US	MICON DES	DESCRIPTION	MCN NO	MCN TYPE	MCN CODE	RACK NO	HIST.	UNITS
205 FIX-2034	B	DAM-COOL	TOTALIZED COOLING AIR TO	7	A	4	7A		SFCM
206 FT--2034	A	DAM AIR	COOLING AIR TO THE REFRA	7	I	12	7A	89	SFCM
207 TIC-2034	B	DAM WALL	COOLING AIR TO DISCHARGE	7	L	4	7A		DEG C
208 TT--2034	A	DAM AIR	SFCM DAM COOLER AIR OUTL	7	I	4	TR	90	DEG C
209 FIR-2035	B	TROUGH-C	COOLING AIR TO THE INCON	7	T	6	7A		SFCM
210 FIX-2035	B	TROUGH-C	TOTALIZED COOLING AIR TO	7	A	5	7A		SFCM
211 FT--2035	A	E TROUGH	COOLING AIR TO THE INCON	7	I	13	7A	91	SFCM
212 TIC-2035	B	E TROUGH	COOLING AIR TO TROUGH -	7	L	5	7A		DEG C
213 TT--2035	A	E TROUGH	SFCM INCONEL TROUGH AIR	7	I	5	TR	92	DEG C
214 TIC-2037	B	H20-OUT	CLCWS SFCM JACKET COOLIN	7	L	7	7A		DEG C
215 TIR-2037	B	WALL CW	TREND WALL CW TEMP	7	T	7			DEG C
216 TT--2037	A	CWR WALL	SFCM COOLING JACKET OUTL	7	I	7	TR	93	DEG C
217 TIC-2038	B	H20-OUT	CLCWS SFCM BOTTOM	7	L	8	7B		DEG C
218 TT--2038	A	CWR BOTM	SFCM COOLING BOTTOM OUTL	7	I	8	TR	94	DEG C
219 TIR-2039	B	AVE TEMP	TREND AVERAGE OF SIX GLA	5	T	3			DEG C
220 TIX-2039	B	AVE TEMP	AVERAGE GLASS TEMPERATUR	5	A	2		126	DEG C
221 ZIX-2039	B	GOOD TCS	NUMBER OF THERMOCOUPLES	5	A	1		128	NO
222 FIC-2040	B	IRTV LEN	COOLING AIR TO IRTV LENS	2	L	4	10		SCFM
223 TT--2040	A	TV-CAM	SFCM NOZZLE B TV CAMERA	6	I	4	TR	101	DEG C
224 FIC-2041	B	IRTV BOD	COOLING AIR TO IRTV BODY	2	L	6	10		%
225 FIN-2041	B	AIR-PLUG	LOW COOLING AIR TO ELECT	7	D	41	6		NORMAL
226 FT--2041	A	IRTV BOD	AIR FLOW TO IRTV BODY CO	2	I	11	10	102	SCFM
227 TT--2041	A	NOZ-M	SFCM NOZZLE M	DA		26	TR	96	DEG C
228 FIN-2042	B	AIR-PLUG	LOW COOLING AIR TO ELECT	7	D	42	6		NORMAL
229 HIN-2042	B	IRTV STM	STEAM BURST TO CLEAN IRT	2	D	46			ON/OFF
230 TT--2042	A	NOZ-M	SFCM NOZZLE CM	DA		27	TR	98	DEG C
231 FIN-2043	B	AIR-PLUG	LOW COOLING AIR TO ELECT	7	D	43	6		NORMAL
232 TT--2043	A	NOZ-M	SFCM NOZZLE M	DA		28	TR	100	DEG C
233 TT--2044	A	NOZ-M	SFCM NOZZLE M	DA		29	TR	105	DEG C
234 TT--2045	A	NOZ-M	SFCM NOZZLE M	DA		37	TR	106	DEG C
235 TT--2047	A	NOZ-M	SFCM NOZZLE M	DA		39	TR	108	DEG C
236 IT--2051	A	BOT ELEC	BOTT ELECTRODE AMPS	DA		89	SR	95	AMPS
237 TIC-2051	B	BOT ELCT	COOLING AIR TO BOTTOM EL	7	L	1	6		DEG C
238 TT--2051	A	BOT ELEC	SFCM BOTTOM ELECTRODE TE	7	I	1	TR	73	DEG C
239 TT--2052	A	EL-20-31	SFCM BOTTOM ELECTRODE TE	DA		41	TR	110	DEG C
240 TT--2053	A	EL-20-31	SFCM BOTTOM ELECTRODE TE	DA		42	TR	111	DEG C
241 TT--2056	A	B EXHAIR	SFCM BOTTOM ELECTRODEMUF	DA		40	TR	109	DEG C
242 IT--2061	A	W ELECT	WEST ELECTRODE AMPS	DA		90	SR	97	AMPS
243 TIC-2061	B	WEST ELT	COOLING AIR TO WEST ELEC	7	L	2	6		DEG C
244 TT--2061	A	WEST ELT	SFCM WEST ELECTRODE TEMP	7	I	2	TR	78	DEG C
245 TT--2062	A	EL-20-32	SFCM WEST ELECTRODE TEMP	DA		46	TR	115	DEG C
246 TT--2063	A	EL-20-32	SFCMWEST ELECTRODE TEMP.	DA		47	TR	116	DEG C
247 TT--2066	A	W EXHAIR	SFCM WEST ELECTRODEMUFFL	DA		45	TR	114	DEG C
248 IT--2071	A	E ELECT	EAST ELECTRODE AMPS	DA		91	SR	99	AMPS
249 TIC-2071	B	EAST ELT	COOLING AIR TO EAST ELEC	7	L	3	6		DEG C
250 TT--2071	A	EAST ELT	SFCM EAST ELECTRODE TEMP	7	I	3	TR	88	DEG C
251 TT--2072	A	EL-20-32	SFCM EAST ELECTRODE TEMP	DA		51	TR	120	DEG C
252 TT--2073	A	EL-20-32	SFCM EAST ELECTRODE TEMP	DA		52	TR	121	DEG C
253 TT--2076	A	E EXHAIR	SFCM EAST ELECTRODEMUFFL	DA		50	TR	119	DEG C
254 TT--2081	A	W-DISC	SFCM DISCHARGE TEMP	DA		55	TR	124	DEG C
255 TT--2082	A	W-DISC	SFCM DISCHARGE TEMP	DA		56	TR	125	DEG C

APPENDIX B
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	TAG	STAT US	MICON DES	DESCRIPTION	MCN NO	MCN TYPE	MCN CODE	RACK NO	HIST.	UNITS
256	TT--2083	A	W-DISC	SFCM DISCHARGE TEMP	DA		57	TR	131	DEG C
257	TT--2084	A	W-DISC	SFCM DISCHARGE TEMP	DA		58	TR	132	DEG C
258	TT--2085	A	W-DISC	SFCM DISCHARGE TEMP	DA		59	TR	133	DEG C
259	TT--2086	A	W-DISC	SFCM DISCHARGE TEMP	DA		60	TR	134	DEG C
260	TT--2091	A	E-DISC	SFCM EAST DISCHARGE TEMP	DA		61	TR	135	DEG C
261	TT--2092	A	E-DISC	SFCM EAST DISCHARGE TEMP	DA		62	TR	136	DEG C
262	TT--2093	A	E-DISC	SFCM EAST DISCHARGE TEMP	DA		63	TR	137	DEG C
263	TT--2094	A	E-DISC	SFCM EAST DISCHARGE TEMP	DA		64	TR	139	DEG C
264	TT--2095	A	E-DISC	SFCM EAST DISCHARGE TEMP	DA		65	TR	140	DEG C
265	TT--2096	A	E-DISC	SFCM EAST DISCHARGE TEMP	DA		66	TR		DEG C
266	TT--2096	A	E-DISC	SFCM EAST DISCHARGE TEMP	DA		66	TR	141	DEG C
267	TIR-2113	B	N R1-66	TREND GLASS TEMP HOT POI	5	T	1			DEG C
268	IIR-2501	A	UPS DC I	UPS CHARGING SYS CURRENT	3	I	1	UP		AMPS
269	IT--2501	A	UPS DCI	UPS BATTERY CURRENT	3	I	1	UP	142	AMPS
270	DIR-3101	B	SBS-BED	TREND SBS BED SOLUTION S	6	T	5	1A		SPGR
271	DT--3101	A	SBS BED	SPECIFIC GRAVITY OF BED	6	I	10	1A	143	SPGR
272	FIN-3101	B	LO-PURGE	LOW INSTRUMENT AIR PURGE	4	D	41	1A		NORMAL
273	LIR-3101	B	SBS BED	SBS SCRUBBER BED LEVEL T	6	T	4	1A		INCHES
274	LIX-3101	B	TRU-LEVL	SBS SCRUBBER BED LEVEL	6	A	5	1A		INCHES
275	LT--3101	A	SBS BED	UNCORRECTED LEVEL IN THE	6	I	9	1A	144	INCHES
276	PDR-3101	B	SCRUBBER	SBS BED DIFFERENTIAL PRE	4	T	7	1A		INCHES
277	PDT-3101	A	BED DP	SBS BED DIFFERENTIAL PRE	4	I	14	1A	145	INCHES
278	TIR-3101	B	GAS-IN	SBS GAS INLET TEMPERATUR	4	T	3	TR		DEG C
279	TT--3101	A	O G IN	SBS INLET GAS TEMPERATUR	4	I	5	TR	146	DEG C
280	PIR-3102	B	SBS-IN	SBS -INLET PRESSURETREND	4	T	2	1A		INCHES
281	PT--3102	A	PRESOGIN	SBS OPERATIONAL PRESSURE	4	I	4	2	147	INCHES
282	TIR-3102	B	VAPOR	SBS UPPER BED TEMPERATUR	4	T	4	TR		DEG C
283	TT--3102	A	O G OUT	SBS OUTLET TEMPERATURE	4	I	6	TR	148	DEG C
284	FIR-3103	B	CWS BED	CW FLOW TO V-31 BED	5	T	6	1B		GPM
285	FIX-3103	B	CWS BED	TOTALIZED CW FLOW INTO V	5	A	5	1B		FT3
286	FT--3103	A	CWS BED	COOLING WATER TO SBS BED	5	I	13	1B	149	GPM
287	TIC-3103	B	CWV31REC	CLCWS SBS BED COOLING WA	6	L	1	1B		DEG C
288	TIR-3103	B	SBS BED	TREND SBS BED TEMPERATUR	3	T	1			DEG C
289	TIR-3103	B	SCRB-LIQ	SBS LOWER BED TEMPERATUR	4	T	1	TR		DEG C
290	TT--3103	A	BED LOW	SBS BED SOLUTION TEMPERA	4	I	2	TR	150	DEG C
291	TT--3104	A	CW OUT	CLCWS SBS COOLING WATER	4	I	7	TR	156	DEG C
292	HIC-3106	B	SCRUB CA	CHEMICAL ADDITION TO SBS	4	L	4	2		ON-OFF
293	FIC-3107	B	SBSB-SPG	AIR SPARGER TO SBS BED	4	L	3	2		SFCM
294	FIX-3107	B	BED-SPAR	TOTALIZED FLOW TO SBS BE	4	A	2	2		GAL
295	FT--3107	A	BED-SPAR	AIR SPARGER TO SBS BED	4	I	3	2	157	SFCM
296	DIR-3111	B	SBS-RECV	TREND SBS RECEIVER SOLUT	4	T	6	1B		SPGR
297	DT--3111	A	SBSREC	SPECIFIC GRAVITY OF RECE	4	I	13	1B	158	SPGR
298	FIN-3111	B	LO-PURGE	LOW INSTRUMENT AIR PURGE	6	D	41	1B		NORMAL
299	LIR-3111	B	SBS REC	SBS RECEIVER LEVEL-TREND	4	T	5	1B		INCHES
300	LIX-3111	B	TRU-LEVL	SBS RECEIVER LEVEL	4	A	4	1B		INCHES
301	LT--3111	A	SBS REC	UNCORRECTED LEVEL IN CFM	4	I	12	1B	159	INCHES
302	TT--3111	A	REC CW	CLCWS SBS RECEIVER COOLI	6	I	12	TR	160	DEG C
303	TIC-3112	B	CWV31REC	CLCWS SBS RECEIVER COOLI	4	L	2	1A		DEG C
304	TIR-3112	B	CWV31REC		4	T	1			DEG C
305	TT--3112	A	REC-LIQ	SBS RECEIVER SOLUTION TE	6	I	1	TR	161	DEG C
306	HIC-3115	B	RECV CA	CHEMICAL ADDITION TO SBS	6	L	3	2		ON-OFF

APPENDIX B
SF-12 INSTRUMENT LIST

TAG	STATUS	MICON DES	DESCRIPTION	MCN NO	MCN TYPE	MCN CODE	RACK NO	HIST.	UNITS
307 FIC-3116	B	SBSR-SPG	AIR SPARGER TO SBS RECEI	6	L	2	2		SFCM
308 FIX-3116	B	REC-SPAR	TOTALIZED FLOW TO SBS RE	6	A	1	2		FT3
309 FT--3116	A	REC-SPAR	AIR SPARGER TO SBS RECEI	6	I	2	2	162	SFCM
310 FIR-3118	B	CWS-RECV	COOLING AIR TO THE RECEI	5	T	7	1A		GPM
311 FIX-3118	B	CWS-RECV	TOTALIZED FLOW TO SBS RE	5	A	6	1A		GAL
312 FT--3118	A	CWS-RECV	COOLING WATER TO SBS REC	5	I	14	1A	163	GPM
313 HIN-3301	B	PHEATER	HEME PRE HEATER INTERLOC	1	D	55			NORMAL
314 TIC-3301	B	E OG HTR	HEME PREHEATER	1	L	7	TR		DEG C
315 TT--3301	A	HTR OUT	OFF GAS TEMP LEAVING HEA	1	I	9	TR	117	DEG C
316 TT--3302	A	HTR IN	OFF GAS FLOW INTO HEATER	DA		49	TR	118	DEG C
317 TT--3303	A	HEATER	PRE-HEATER TEMPERATURE	DA		53	TR	113	DEG C
318 FT--3401	A	HEME IN	OFF-GAS FLOW INTO HEME V	2	I	1	15	164	SFCM
319 PDT-3401	A	HEME DP	HEME V-34 DIFFERENTIAL P	2	I	3	15	165	INCHES
320 PT--3401	A	HEME VAC	HEME V-34 VACUUM	2	I	2	15	166	INCHES
321 PDT-3501	A	MST ELIM	MIST ELIMINATOR DIFFEREN	2	I	4	15	167	INCHES
322 PDT-3601	A	PREHEATR	PREHEATER V-36 DIFFERENT	2	I	6	15	169	INCHES
323 TT--3601	A	PREHEATR	PREHEATER OUTLET TEMPERA	1	I	7	TR	170	DEG C
324 FIC-3611	B	PREHEATR	STEAM CONTROL FOR HEPA P	1	L	6	4		SFCM
325 FIX-3611	B	TOT-STM	TOTALIZED STEAM FLOW HEP	1	A	2	4		LB
326 FT--3611	A	STEAM-FL	STEAM FLOW TO HEPA PREHE	1	I	6	4	171	SFCM
327 PT--3611	A	PREHEATR	STEAM PRESSURE TO HEPA P	1	I	14	4	172	INCHES
328 TIC-3611	B	PREHEATR	TEMP CONT OF HEPA PREHEA	1	L	6			DEG C
329 PDT-3701	A	HEPA DP	HEPA FILTER DIFFERENTIAL	2	I	7	15	174	INCHES
330 PT--3701	A	HEPA OUT	HEPA OUTLET VACUUM	2	I	10	15	176	INCHES
331 TT--3701	A	HEPA AIR	HEPA PREHEATER TEMPERATU	DA		7	TR	175	DEG C
332 PT--3702	A	CTS END	TRENCH PIPE INLET PRESSU	2	I	9	15	177	INCHES
333 PIN-4101	B	LO-PURGE	LOW INSTRUMENT AIR PURGE	3	D	43	8		NORMAL
334 IT--4101	A	MOT-TURN	TURNTABLE DRIVE MOTOR CU	3	I	5	MC		AMPS
335 TIC-4101	B	CWV-41	CLCWS TURNTABLE COOLING	3	L	6	8		DEG C
336 TIR-4101	B	TURN LIQ	TREND OF TURNTABLE TEMPE	3	T	7			DEG C
337 TT--4101	A	TURN-LIQ	TURNTABLE TEMPERATURE	3	I	6	TR	183	DEG C
338 WT--4101	A	TURN-W	TURNTABLE CANISTER WEIGH	3	I	8	TR	254	LB
339 ZT--4101	B	TURN	TURNTABLE POSITION	3	I	13	TR	263	
340 LT--4102	A	TURN	UNCORRECTED LEVEL IN TUR	3	I	11	8	184	INCHES
341 PIR-4102	B	TURN	TURNTABLE OPERATIONAL PR	3	T	6	8		INCHES
342 PT--4102	A	VACUUM	TURNTABLE OPERATIONAL PR	3	I	12	8	185	INCHES
343 TIR-4102	B	H20-OUT	CLCWS TURNTABLE OUTLET T	7	T	8	TR		DEG C
344 TT--4102	A	CWR TT	TURNTABLE CLCW TEMPERATU	7	I	15	TR	186	DEG C
345 FIR-4109	B	CWS-TT	COOLING WATER TO THE TUR	5	T	8	8		GPM
346 FIX-4109	B	CWS-TT	TOTALIZED COOLING WATER	5	A	7	8		GAL
347 FT--4109	A	CWS-TT	COOLING WATER TO TURNTAB	5	I	15	8	187	GPM
348 TT--4109	A	LOAD CEL	TEMPERATURE AT TT LOAD C	DA		54	TT		DEG C
349 AI--4601	A	NOX IN	NOX ANALYZER AT SCR INLE	16	I	6	PP	266	PPM
350 FT--4601	A	SCR GAS	INLET GAS FLOW TO SCR	16	I	4	PP	264	SFCM
351 PT--4601	A	BED PRES	REACTOR INLET PRESSURE	16	I	7		267	INCHES
352 TT--4601	A	FLWMTR	SCR INLET AT FLOWMETER	16	I	1	PP	260	
353 AI--4602	A	NOX OUT	NOX ANALYZER AT SCR OUTL	16	I	5	PP	265	PPM
354 TT--4602	A	BED A	SCR BED TOP A	16	I	2	PP	261	DEG C
355 AIX-4603	B	NOX EFF	SCR COLUMN EFFECIENCY	16	A	2		130	PCT
356 FIX-4603	B	NH3 FLOW	AMMONIA FLOW CALCULATION	16	A	1	SCR	129	LITERS
357 TT--4603	A	BED E	SCR REACTOR BED OUTLET E	16	I	3	PP	262	DEG C

APPENDIX B
SP-12 INSTRUMENT LIST

TAG	STATUS	MICON DES	DESCRIPTION	MCN NO	MCN TYPE	MCN CODE	RACK NO	HIST.	UNITS
358 TT--4604	A	RXT IN	SCR REACTOR INLET	16	I	8	SCR	270	DEG C
359 TT--4605	A	BED B	REACTOR BED MIDDLE #B	16	I	9	SCR	271	DEG C
360 TT--4606	A	BED C	REACTOR BED MIDDLE #C	16	I	10	SCR	272	DEG C
361 TT--4607	A	BED D	REACTOR BED BOTTOM #D	16	I	11	SCR	273	DEG C
362 TT--4608	A	RXT OUT	SCR REACTOR OUTLET	16	I	12	SCR	274	DEG C
363 TT--4609	A	SKID OUT	SKID OUTLET / RETURN TEM	16	I	13	SCR	275	DEG C
364 TT--4610	A	RXT PHTR	REACTOR PREHEATER OUTLET	16	I	14	SCR	276	DEG C
365 AIC-4611	B	NOX EFF	NOX DESTRUCTION EFFECIEN	16	L	1	PP	268	%
366 FT--4611	A	NH3 FLOW	AMMONIA FLOW RATE TO REA	16	I	8	PP		LPM
367 AIC-4612	B	AMM/NOX	AMMONIA / NOX RATIO	16	L	2	PP		
368 TT--5801	A	CWS HDR	CLCWS RETURN HEADER TEMP	5	I	5		256	DEG C
369 TT--5802	A	CWS HDR	CLCWS SUPPLY HEADER TEMP	5	I	4		257	DEG C
370 TT--5811	A	TOWR SPL	PLANT COOLING WATER SUPP	5	I	7		258	DEG C
371 TT--5812	A	TOWR RTN	PLANT COOLING WATER RETU	5	I	8		259	DEG C
372 PIC-5830	B	CLCW-LPH	CLCWS LOW PRESSURE HEADE	4	L	8	66		PSIG
373 PT--5830	A	LPCWLOOP	CLCWS-LOW PRESSURE HEADE	4	I	10	66	4	PSIG
374 PIC-5836	B	CLCW-HPH	CLCWS HIGH PRESSURE HEAD	4	L	7	66		PSIG
375 PT--5836	A	HPCWLOOP	CLCWS-HIGH PRESSURE HEAD	4	I	9	66	3	PSIG
376 FIR-5840	B	CLCWT-FL	CLCWS TOTAL FLOW TREND	4	T	8	66		GPM
377 FIX-5840	B	CLCW-TFL	CLOSED LOOP COOLING INTE	4	A	3			GPM
378 FT--5840	A	VITOP-CW	SYSTEM 66 CLCW TOTAL FLO	4	I	11	66	7	GPM
379 AI--6101	B	NOX	TOTAL NOX LOOP DISPLAY	15	L	2			PPM
380 AT--6101	A	NOX	TOTAL NOX FROM ONLINE MO	15	I	2		180	PPM
381 FIR-6101	B	NOX INLT		13	T	1			SFCM
382 FT--6101	A	NOX INLT	FLOW RATE OF INLET TO PR	13	I	1		189	SFCM
383 PDR-6101	B	PRI SCBR	TREND PRIMARY NOX COL PR	13	T	2			INCHES
384 PDT-6101	A	PRIMSCRB	PRIMARY SCRUBBER DIFFERE	13	I	13		188	INCHES
385 PT--6101	A	INLET	PRIMARY COL INLET PRESSU	15	I	9		178	INCHES
386 TT--6101	A	PSCR BOT	PRIMARY SCRUBBER TEMP -	14	I	5		190	DEG C
387 AI--6102	B	NO	NO LOOP DISPLAY	15	L	3			PCT
388 AT--6102	A	NO	NO FROM OL LINE MONITOR	15	I	3		181	PCT
389 TT--6102	A	PSCR MID	PRIMARY SCRUBBER TEMP -	14	I	4		191	DEG C
390 TT--6103	A	PSCR TOP	PRIMARY SCRUBBER TEMP-TO	14	I	3		192	DEG C
391 DT--6201	A	PRI SURG	PRIMARY SURGE TANK SPECI	13	I	7		193	SPGR
392 LT--6201	A	PRI SURG	PRIMARY SURGE TANK LEVEL	13	I	5		194	INCHES
393 TT--6201	A	PRI SURG	PRIMARY SURGE TANK TEMP	14	I	1		195	DEG C
394 TT--6501	A	PRI COOL	TEMP AT PRIMARY COOLER	13	I	12		196	DEG C
395 LT--6601	A	PRI LVPT	PRIMARY LEVEL POT MEASUR	13	I	3		197	INCHES
396 DT--6701	A	PRI STOR	PRIMARY STORAGE TANK SPE	13	I	11		198	SPGR
397 LT--6701	A	PRI STOR	PRIMARY STORAGE TANK	13	I	9		199	INCHES
398 PDR-7101	B	SEC SCBR	TREND SECONDARY NOX COL	13	T	3			INCHES
399 PDT-7101	A	SEC SCRB	SECONDARY SCRUBBER DIFFE	13	I	15		200	INCHES
400 TT--7101	A	SEC SCRB	SECONDARY SCRUBBER TEMP	14	I	6			DEG C
401 DT--7201	A	SEC SURG	SECONDARY SURGE TANK SPE	13	I	6		207	SPGR
402 LT--7201	A	SEC SURG	SECONDARY SURGE TANK LEV	13	I	4		208	INCHES
403 TT--7201	A	SEC SURG	SECONDARY SURGE TANK TEM	14	I	2		209	DEG C
404 TT--7501	A	SEC COOL	SECONDARY RECIRCUIATION	13	I	14		210	DEG C
405 LT--7601	A	SEC LVPT	SECONDARY LEVEL POT MEAS	13	I	2		211	INCHES
406 DT--7701	A	SEC STOR	SECONDARY STORAGE TANK S	13	I	10		212	SPGR
407 LT--7701	A	SEC STOR	SECONDARY STORAGE TANK L	13	I	8		213	INCHES
408 TT--7701	A	SEC SCRB	SEC STORAGE TANK	14	I	6		214	DEG C

APPENDIX B
SF-12 INSTRUMENT LIST

TAG	STAT US	MICON DES	DESCRIPTION	MCN NO	MCN TYPE	MCN CODE	RACK NO	HIST.	UNITS
409 PT--8101	A	REHTRVAC	REHEATER PROCESS VACUUM	14	I	12		215	INCHES
410 TT--8101	A	REHTR IN	REHEATER INLET TEMP	14	I	8		216	DEG C
411 TT--8102	A	REHTROUT	REHEATER OUTLET TEMP (CO	14	I	7		217	DEG C
412 PDT-8601	A	E HEPA	FINAL HEPA A DIFFERENTIA	14	I	13		218	INCHES
413 PDT-8701	A	W HEPA	FINAL HEPA B DIFFERENTIA	14	I	14		219	INCHES
414 IT--8801	A	ELEC BLR	ELECTRIC O G BLOWER CURR	15	I	1		224	AMPS
415 PT--8801	A	BLR VAC	BLOWER SUCTION PRESSURE	14	I	9		220	INCHES
416 TT--8801	A	BLR OUT	BLOWER OUTLET TEMPERATUR	14	I	10		221	DEG C
417 PT--8802	A	BLR OUT	BLOWER DISCHARGE PRESSUR	14	I	15		222	INCHES
418 TT--8802	A	BLR INLT	BLOWER INLET TEMPERATURE	14	I	11		223	DEG C
419 UIX-9903	B	625 RNG	O G NOx CONC 0-625 PPM	15	A	1	114	235	PPM
420 UIX-9904	B	2500 RNG	O G NOx CONC 0-2500 PPM	15	A	2	114	236	PPM
421 UIX-9905	B	6250 RNG	O G NOx CONC 0-6250 PPM	15	A	3	114	237	PPM
422 UIX-9906	B	25 K RNG	O G NOx CONC 0-25000 PPM	15	A	4	114	238	PPM
423 UIX-9907	B	625 RNG	O G NO CONC 0-625 PPM	15	A	5	114	239	PPM
424 UIX-9908	B	2500 RNG	O G NO CONC 0-2500 PPM	15	A	6	114	240	PPM
425 UIX-9909	B	6250 RNG	O G NO CONC 0-6250 PPM	15	A	7	114	241	PPM
426 UIX-9910	B	25 K RNG	O G NO CONC 0-25000 PPM	15	A	8	114	242	PPM
427 HY-0103C	B			9	D	23	4		
428 HV-0115B	B			10					
429 HY-0115A	B			10					
430 HY-0305A	B			10					
431 HY-0305B	B			10					
432 HY-0305C	B			10					

APPENDIX C
SAMPLE PLAN SUMMARY
SF-12 (WEEK 1)

DATE (OCT)	LOCATION	START TIME (HRS)	DURATION (HRS)
03	1	0800	1
	1	0900	1*
	2	0900	1*
	3	0900	14
	1	1600	1*
	2	1600	1*
04	1	0900	1*
	2	0900	1*
	3	0900	14
	1	1600	1*
	2	1600	1*
05	1	0900	1*
	2	0900	1*
	3	0900	14
	1	1600	1*
	2	1600	1*
06	1	0900	1
	2	0900	1
	3	0900	14
	1	1200	1
	2	1200	1
	1	1600	1**
	2	1600	1**
	1	2000	1**
	2	2000	1**
07	1	0900	1
	2	0900	1
	3	0900	14
	1	1200	1
	2	1200	1
	1	1600	1
	2	1600	1**
	1	2000	1
	2	2000	1**
08	1	0900	1
	2	0900	1
	3	0900	14
	1	1200	1
	2	1200	1

* replace filters to increase sample volume collected
** use cascade impactor or approved equivalent

APPENDIX C (CONTINUED)
SAMPLE PLAN SUMMARY
SF-12 (WEEK 2)

DATE (OCT)	LOCATION	START TIME (HRS)	DURATION (HRS)
09	1	0900	1
	2	0900	1
	3	0900	14
	1	1200	1
	2	1200	1
	1	1600	1**
	2	1600	1**
	1	2000	1**
	2	2000	1**
10	1	0900	1
	2	0900	1
	3	0900	14
	1	1200	1
	2	1200	1
	1	1600	1
	2	1600	1**
	1	2000	1
	2	2000	1**
11	1	0900	1
	2	0900	1
	3	0900	14
	1	1200	1
	2	1200	1
12	1	0900	1
	2	0900	1
	3	0900	14
	4	0900	1
	2	1200	1
	1	1600	1
	2	1600	1
	4	1600	1
	2	2000	1
13	1	0900	1
	2	0900	1**
	3	0900	1
	2	1200	1
	1	1600	1
	2	1600	1
	2	2000	1

** use cascade impactor or approved equivalent

APPENDIX C (CONTINUED)
SAMPLE PLAN SUMMARY
SF-12 (WEEK 2 - CONTINUED)

DATE (OCT)	LOCATION	START TIME (HRS)	DURATION (HRS)
14	1	0900	1
	2	0900	1
	3	0900	14
	2	1200	1
	1	1600	1
	2	1600	1
	2	2000	1
15	1	0900	1
	2	0900	1**
	3	0900	14
	2	1200	1
	1	1600	1
	2	1600	1
	2	2000	1

** use cascade impactor or approved equivalent

APPENDIX C (CONTINUED)
SAMPLE PLAN SUMMARY
SF-12 (WEEK 3)

DATE (OCT)	LOCATION	START TIME (HRS)	DURATION (HRS)
16	1	0900	1
	2	0900	1
	3	0900	14
	4	0900	1
	2	1200	1
	1	1600	1
	2	1600	1
	4	1600	1
	2	2000	1
17	2	0900	1
	3	0900	14**
18	2	0900	1
	3	0900	14**
19	1	0900	1
	2	0900	1
	3	0900	14
	4	0900	1
	2	1600	1
	4	1600	1
20	2	0900	1
	3	0900	14
21	2	0900	1
	3	0900	14
22	2	0900	1
	3	0900	14

** use cascade impactor or approved equivalent

APPENDIX C (CONTINUED)
SAMPLE PLAN SUMMARY
SF-12 (WEEK 4)

DATE (OCT)	LOCATION	START TIME (HRS)	DURATION (HRS)
23	1	0900	1
	2	0900	1
	3	0900	14
	4	0900	1
	2	1600	1
	4	1600	1
24	2	0900	1
	3	0900	14**
25	2	0900	1
	3	0900	14**
26	1	0900	1
	2	0900	1
	3	0900	14
	4	0900	1
	2	1600	1
	4	1600	1
27	2	0900	1
	3	0900	14
28	2	0900	1
	3	0900	14
	4	0900	1
29	2	0900	1
	3	0900	14

** use cascade impactor or approved equivalent

APPENDIX C (CONTINUED)
SAMPLE PLAN SUMMARY
SF-12 (WEEK 5)

DATE (OCT)	LOCATION	START TIME (HRS)	DURATION (HRS)
30	1	0900	1
	2	0900	1
	3	0900	14
	4	0900	1
	2	1600	1
	4	1600	1
31	2	0900	1
	3	0900	14**
01NOV	2	0900	1
	3	0900	14**
02	1	0900	1
	2	0900	1
	3	0900	14
	4	0900	1
	2	1600	1
	4	1600	1
03	2	0900	1
	3	0900	14
04	2	0900	1
	3	0900	14**
	4	0900	1
05	2	0900	1
	3	0900	14**

** use cascade impactor or approved equivalent

APPENDIX C (CONTINUED)
SAMPLE PLAN SUMMARY
SF-12 (WEEK 6)

DATE (OCT)	LOCATION	START TIME (HRS)	DURATION (HRS)
06	1	0900	1
	2	0900	1
	3	0900	14
	4	0900	1
	2	1600	1
	4	1600	1
07	2	0900	1
	3	0900	14
08	2	0900	1
	3	0900	14**
09	2	0900	1
	3	0900	14*8
10	2	0900	1
	3	0900	14
11	2	0900	1
	3	0900	14
12	2	0900	1
	3	0900	14

** use cascade impactor or approved equivalent

APPENDIX C (CONTINUED)
SAMPLE PLAN SUMMARY
SF-12 (WEEK 7)

DATE (OCT)	LOCATION	START TIME (HRS)	DURATION (HRS)
13	2	0900	1
	3	0900	14
14	2	0900	1
	3	0900	14
15	2	0900	1
	3	0900	14
16	1	0800	1
	1	0900	1
	2	0900	1
	3	0900	18
	1	1200	1
	2	1200	1
	1	1600	1
	2	1600	1
	1	2000	1
	2	2000	1
17	1	0000	1
	2	0000	1
	1	0400	1
	2	0400	1
	1	0800	1
	2	0800	1
	3	0800	14
	1	1200	1
	2	1200	1
	1	1600	1
	2	1600	1
	1	2000	1
	2	2000	1
18	1	0900	1
	2	0900	1
	3	0900	14
	1	1600	1
	2	1600	1

APPENDIX C (CONTINUED)
SAMPLE PLAN SUMMARY
SF-12 (WEEK 7 - CONTINUED)

DATE (OCT)	LOCATION	START TIME (HRS)	DURATION (HRS)
19	1	0800	1
	2	0800	1
	1	0900	1
	2	0900	1
	3	0900	14
	1	1200	1
	2	1200	1
	1	1600	1
	2	1600	1
	1	2000	1
	2	2000	1

APPENDIX C (CONTINUED)
SAMPLE PLAN SUMMARY
SF-12 (WEEK 8)

DATE (OCT)	LOCATION	START TIME (HRS)	DURATION (HRS)
20	1	0900	1
	2	0900	1
	3	0900	14
	1	1200	1
	2	1200	1
	1	1600	1
	2	1600	1
	1	2000	1
	2	2000	1
21	1	0900	1
	2	0900	1
	1	1200	1
	2	1200	1

APPENDIX D

PROCESS CONTROL STRATEGY - SUMMARY

I. Glass Processing Temperature

See section 6.1 for description of melter power control. Set points are listed from the Run Sheet Values in section 5.3.

A. Temperature Sensing

1. Temperature array in two thermowells:

   a) glass
   b) boundary layer
   c) plenum

2. Type K thermocouples 1/8 inch, Inconel sheath mineral insulated with option for Type N, or Type K - high temperature for longer life under investigation

3. Thermocouples change about every 12 weeks, staggered so that every 6 weeks T/Cs in one thermowell are changed.

4. Temperatures are compared well to well, and profile is compared to expected result.

5. Thermocouple response checked prior to run and signed off.

6. Temperature alarms set to annunciate on out of specification response.

7. Replace well every 24 weeks.

8. Electrode temperature (bottom electrode to be greater than 1,000°C).

B. Temperature Control

1. Control set to average temperature of bulk glass - 6 T/Cs, three each from the two thermowells.

2. Each T/C alarms on "failure" and is pulled out of the average.

3. Average temperature also alarmed for control action, and time filtered to suppress control action.

4. Temperature control output directly to circuit A, the top melter circuit, with ratio control to the other two circuits independently (both circuits are at A 1:1.45 ratio).

5. Temperature control to $\pm 10^{\circ}C$ under normal operation and $\pm 20^{\circ}C$ for transients.

6. Electrode cooling control to limit high temperature (side electrodes less than $1050^{\circ}C$, and bottom less than $1090^{\circ}C$.

C. Power Distribution

1. Three electrode designed to distribute power to give more even heating.

2. Increase temperature at the bottom of the melter.

D. Changes, Recovery, and Troubleshooting

1. Thermocouples

a) T/C is declared "bad" after one unexplained excursion, note in log book.

b) readjust/verify position of T/C as needed.

c) replace individual T/C during run if bad.

d) replace bundle if more than 2 T/C go bad at one time, T-well may be replaced if there are indications of failure

2. Temperature Control Loop

a) set point $1150^{\circ}C$ change only for temporary recovery i.e., hot streaking

b) loop tuning as necessary to maintain control parameters above

E. Discharge Temperature

1. Average temperature $1100^{\circ}C$, minimum for pouring.

II. Feed Rate Control

A. Rate Control

1. ADS pump transfers a fixed volume to the melter each pump cycle. Transfer by air pressure.

2. Feed rate input to DCS, pump cycle calculated and adjusted based on feed tank level.

B. Rate Measurement/Verification

Glass and slurry data is taken and processed per section 8.1.2 and 8.1.3.

1. Magnetic flow meter reliable, non-invasive but not designed for pulsed flow - integration of pulsed signal for volume and rate calculations. Pulse shape provides qualitative pump performance.

2. MFT level change, long times necessary for meaningful measurement - level instruments not accurate.

   a) purged dip tubes - plugs with slurry

   b) cosa diaphragms - not responsive for small changes

   c) capacitance level - sensitive to foam and slurry bridges on the probe

   d) dip stick - not to be used for process control

3. SFCM level change, glass production rate and not feed rate. It could vary from corrosion of melter walls or slurry characteristics. Most accurate to date.

4. Plenum temperature change (from steady-state) can indicate change in feed rate.

5. ADS delivered volume measurement, stroke times frequency is rate - not to be used for process control. See section 6.3 for ADS pump control.

C. Flushing

1. ADS pump - flush once a day minimum, more as necessary, log all flushes (normal flush is toward melter). See section 6.3 for ADS pump control.

2. Level probes (dip tubes).

   a) air twice per shift
   b) water if necessary

D. Changes, Recovery, and Troubleshooting

1. Feed Rate

a) start up per Activity Diagram (Ramp)

b) change ADS pump setting to hold average plenum temperature between 475 and 525°C

c) with plenum >575, do not change feed rate more often than 4 to 6 hours, unless it is to turn off feed

2. Pump Settings

a) push time currently 15 seconds

b) water flush time currently 30 seconds

c) changes

III: Product Composition

See section 5.1.2 for a discussion of feed make-up and composition.

See section 8.9 for sampling plan.

A. Feed Sampling

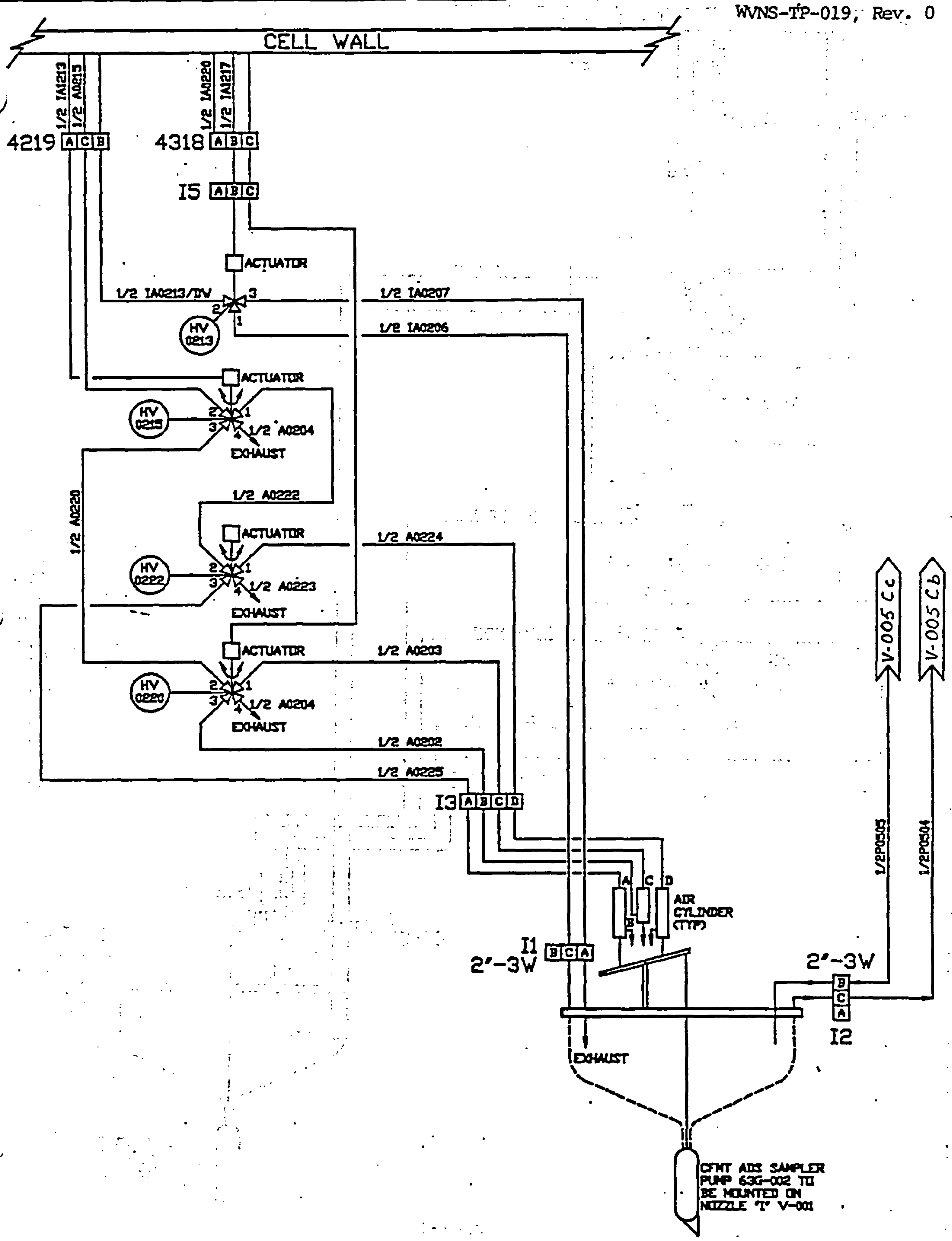
1. Waste and cold chemicals - analysis such that all species over 1 percent have a mean sample analysis with a 95 percent confidence band <10 percent of the mean.

2. Feed slurry:

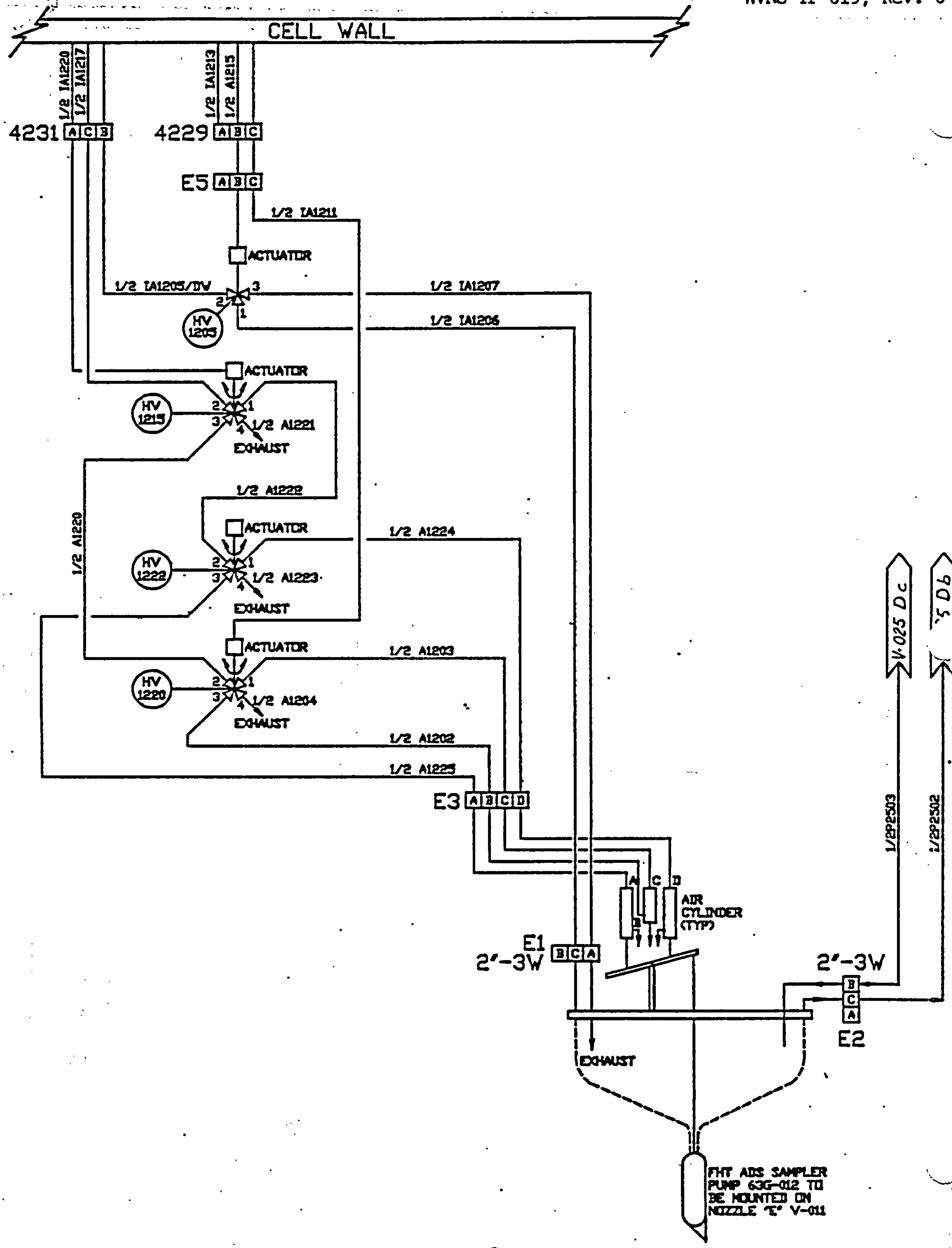
a) analysis such that all species over 1 percent have a mean sample analysis with a 95 percent confidence band <10 percent of the mean

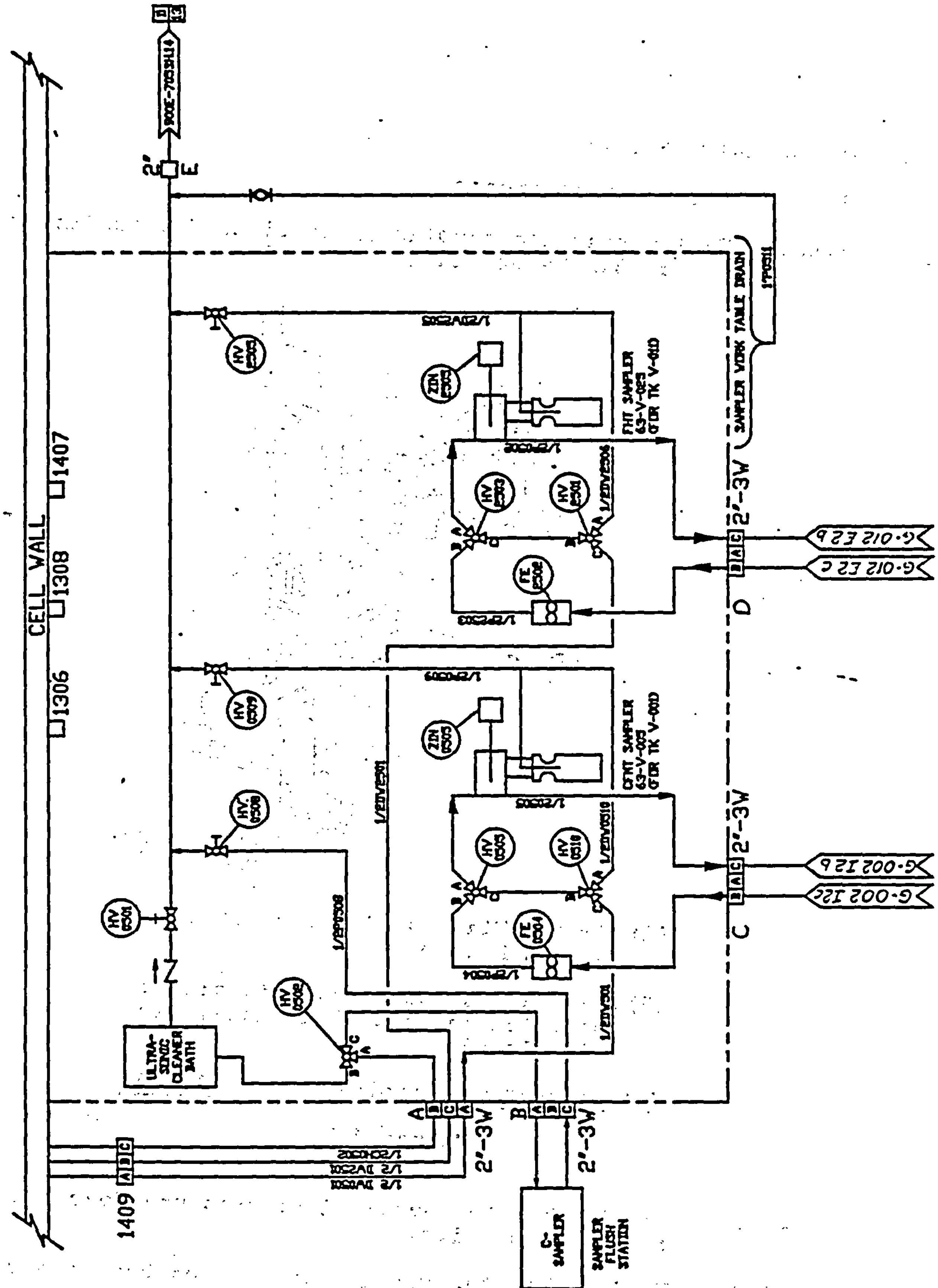
b) means of all species over 1 percent fall within tolerance band for standard composition

B. Glass - samples and canister weight to close a material balance.



CELL WALL
1/2 IA1213
1/2 A0215
1/2 IA0220
1/2 IA1217
4219 A C B
4318 A B C
I5 A B C
ACTUATOR
1/2 IA0213/DW
1/2 IA0207
1/2 IA0206
HV 0213
ACTUATOR
HV 0215
1/2 A0204
EXHAUST
1/2 A0222
1/2 A0220
ACTUATOR
1/2 A0224
HV 0222
1/2 A0223
EXHAUST
ACTUATOR
1/2 A0203
HV 0220
1/2 A0204
EXHAUST
1/2 A0202
1/2 A0225
I3 A B C D
V-005 Cc
V-005 Cb
1/2P0505
1/2P0504
AIR CYLINDER (TYP)
I1
2"-3W
B C A
2"-3W
B C A
I2
EXHAUST
CFMT ADS SAMPLER PUMP 63G-002 TO BE MOUNTED ON NOZZLE 'T' V-001

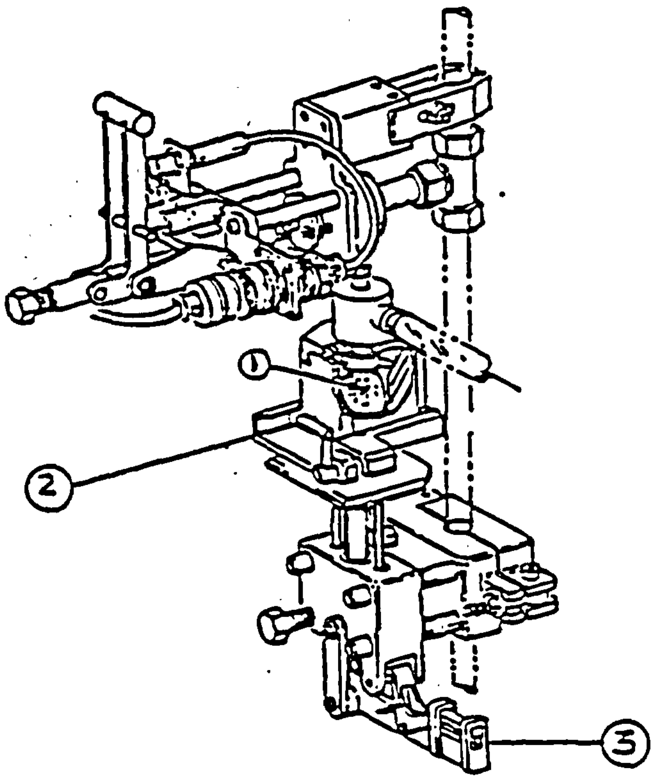

CELL WALL
1/2 IA1220
1/2 IA1217
1/2 IA1213
1/2 A1215
4231 A C B
4229 A B C
E5 A B C
1/2 IA1211
ACTUATOR
1/2 IA1205/DV
1/2 IA1207
1/2 IA1206
HV 1205
ACTUATOR
HV 1215
1/2 A1221
EXHAUST
1/2 A1222
ACTUATOR
1/2 A1224
HV 1222
1/2 A1223
EXHAUST
1/2 A1220
ACTUATOR
1/2 A1203
HV 1220
1/2 A1204
EXHAUST
1/2 A1202
1/2 A1225
E3 A B C D
AIR CYLINDER (TYP)
E1 2"-3W B C A
2"-3W
B C A
E2
EXHAUST
V-025 Dc
1/2P2503
1/2P2502
FHT ADS SAMPLER PUMP 63G-012 TO BE MOUNTED ON NOZZLE "E" V-011


CELL WALL
1306
1308
1407
1409
ULTRA-SONIC CLEANER BATH
C-SAMPLER
SAMPLER FLUSH STATION
SAMPLER WORK TABLE DRAIN
2"-3W
2"-3W
2"-3W
2"-3W
A
B
C
D
E
2"

3.0 OPERATING PROCEDURE

3.1 PREPARING TO SAMPLE

3.1.1 Verify that the sampler is configured according to Figure 3.1 before taking a sample.



(1) Sample Vial in proper position in Shroud Assembly

(2) Shroud Assembly locked in proper position in Tilt Plate Assy, with Lid closed

(3) Raise/Lower Handle locked closed

Figure 3.1

3.1.2 Verify that the supply line pressure does not exceed 50 p.s.i.g.

3.1.3 Verify that the display or lamp on the site control panel which indicates the limit switch status is lit or positive in the "Valve Closed" position.

3.2 TAKING A SAMPLE

3.2.1 Verify that the Sampler Handle is in its locked closed position by lightly pushing the end of the Handle (V) (position #1 in Figure 3.2) in the direction of the supply pipeline. When the Sampler Handle is locked, its over-center cam-lock closure position and its springs should prevent the Handle from moving by itself.

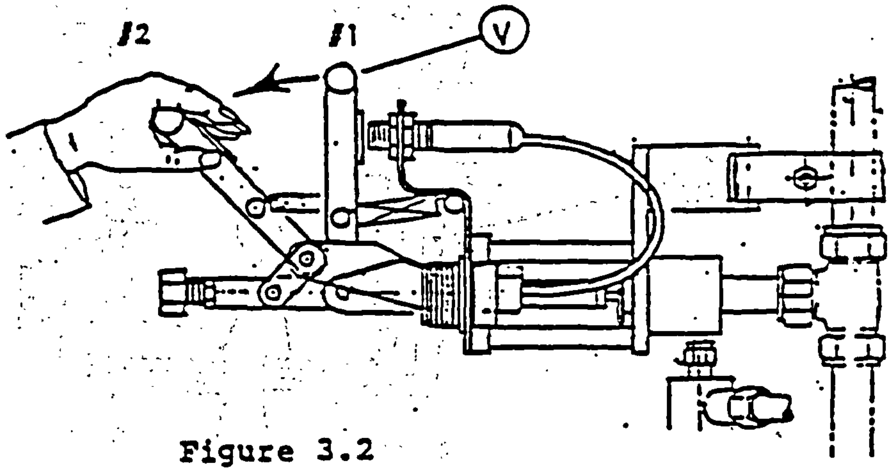


Figure 3.2

3.2.2 Grasp the Sampler Handle (V) and pull back steadily until the Handle reaches the limit of its travel (position #2 in Figure 3.2). The valve status indicator on the site control panel will indicate "Valve Open". Hold the Handle in this position for 3-4 seconds (or a period of time defined by some other specific site sampling procedure) and then steadily return the Handle to its closed locked position. The sample vial, visible through the Shroud Assembly, will have filled with a sample of the process flow to a predetermined level.

3.3 REMOVING (AND REINSERTING) THE SAMPLE VIAL

3.3.1 Verify that the Shroud Retaining Pin (T) is in the closed locked position (Figure 3.3).

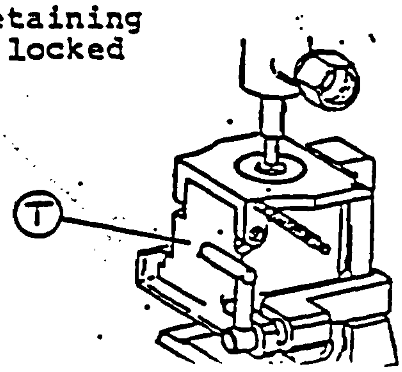


Figure 3.3

3.3.2 Grasp the Raise/Lower Handle (R) and press the Retaining Bar down to unlock the Handle. Pull the Handle down (and then back up) through its 180 degree travel to its open position. (Refer to Figure 3.4.) USE EXTREME CAUTION WHEN LOWERING THE HANDLE TO INSURE THAT IT DOES NOT STRIKE THE MAIN RAISE/LOWER SHAFT (KK) AT (LL) WHEN THE HANDLE REACHES THE END OF ITS LOWERING CYCLE STROKE.

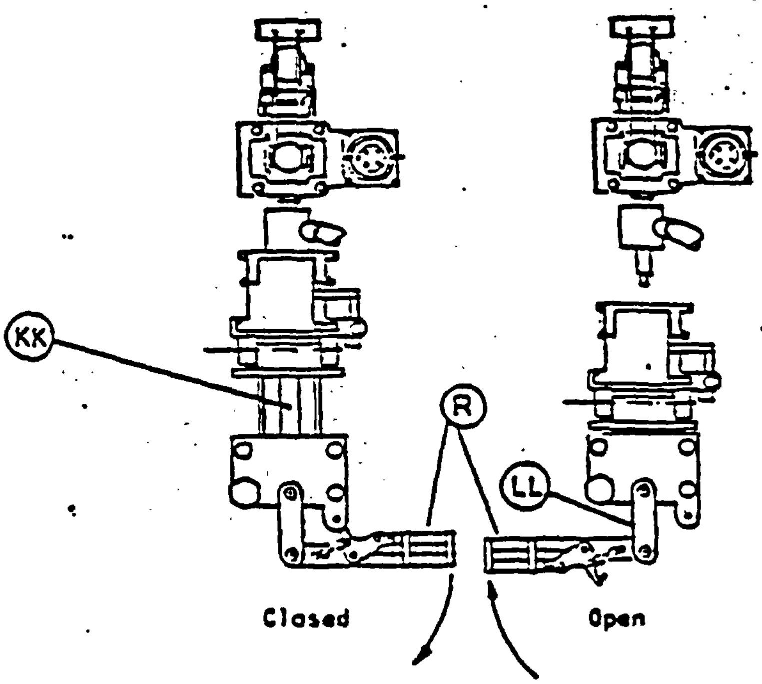


Figure 3.4

3.3.3 Grasp the front edge (W) of the Tilt Plate Assembly (U) and pull down until it reaches its open position after 45 degrees of travel. Refer to Figure 3.5.

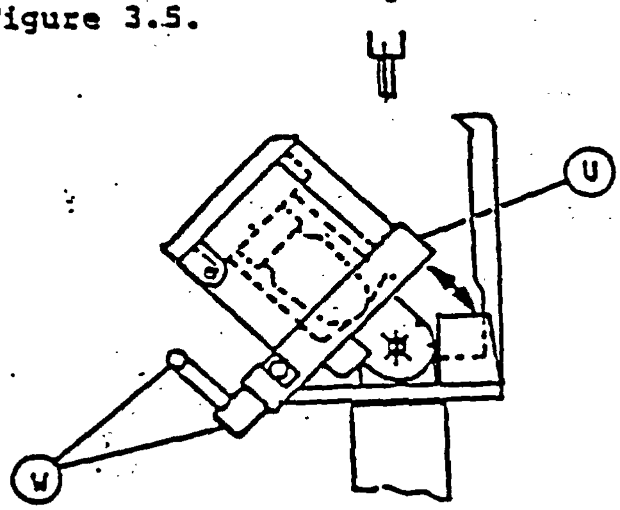


Figure 3.5

3.3.4 Grasp the back edge of the Shroud Lid (X) and pull it forward and open, as indicated in Figure 3.6.

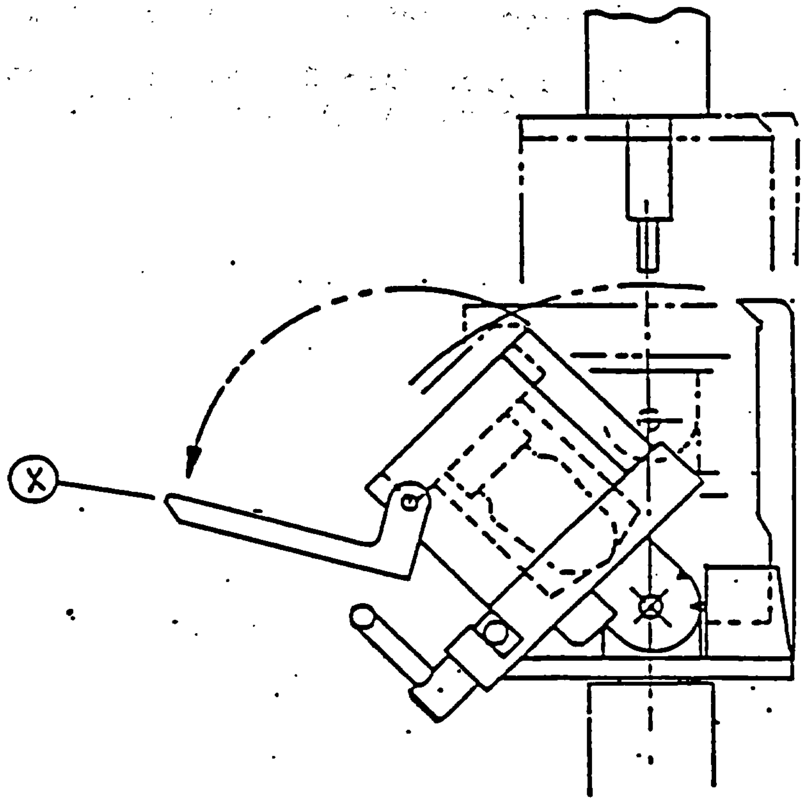


Figure 3.6

3.3.5 Reach into the open top of the Shroud Assembly and remove the sample vial.

3.3.6 Place an empty vial into the open Shroud Assembly and close the Shroud Lid (reverse of procedure 3.3.4).

3.3.7 Grasp the front edge of the Tilt Plate Assembly and pull it up and forward until it reaches its open position (reverse of procedure 3.3.3).

3.3.8 Grasp the Raise/Lower Handle (R) which should be in its open position and pull the handle down and then back up to its closed locked position so that the Vial Handler Mechanism is again in the raised position. (Refer to Figure 3.4.) The sampler system is now ready to repeat procedure 3.2, "Taking a Sample".

3.4.4 To prepare the system for sampling again, slide a Shroud Assembly (D) into the Tilt Plate Assembly (U). The Shroud should be inserted so that the lid hinge edge is away from the supply pipeline, and the Vial Handler Mechanism should be in the lowered open position. Refer to Figure 3.8.

3.4.5 Grasp the Shroud Retaining Pin (T) and rotate it counterclockwise 90 degrees to its closed position

3.4.6 Repeat procedure 3.3.8. The sampler system is now ready to repeat procedure 3.2, "Taking a Sample".